

Progress of the Cockburn Sound Study



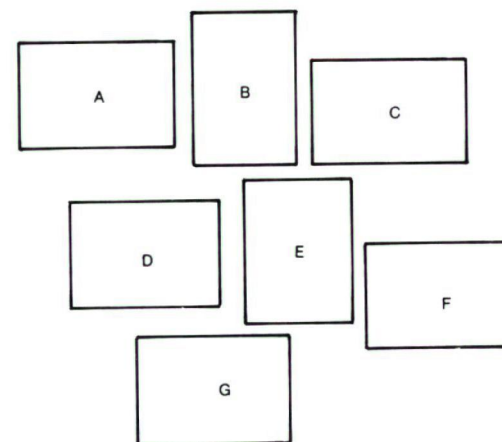
June 1978

DEPARTMENT OF CONSERVATION AND ENVIRONMENT
BULLETIN No. 41



COVER LEGEND

- A Study Group divers measuring the growth of tagged seagrass leaves.
- B Trawl net bringing in a fish catch during the Study Group's fish sampling programme.
- C Study Group marine chemist using an atomic absorption spectrophotometer for the analysis of heavy metals in biota.
- D Industry sited on the shores of Cockburn Sound.
- E The Study Group scientists filtering seawater samples for the research programme on nutrient distribution and phytoplankton density.
- F Palm Beach on a summer's day during the Study Group's Recreation Survey.
- G Study Group diver collecting a sediment core for analysis.



The Study Objectives

The objective is to obtain the information necessary to manage the Sound for multi-purpose use by the community, accommodating recreational and fishing activities as well as utilization for port and industry. The framework of the Study is directed towards:

- **analysis of social and recreational uses**
- **assessment of fish production and potential**
- **monitoring of industrial discharges**
- **appraisal of water movements**
- **examination of the condition of seagrass**
- **movements of sediments**
- **the causes of algal blooms**

In addition, closely related aspects are being studied by other departments and institutions. These ancillary investigations being carried out at little additional cost (some being borne by the department concerned), are enhancing the value of the overall Study.

Operations began in November 1976 with the appointment of Dr. Graham Chittleborough as the Project Leader, followed in the next few months by the recruitment of staff (a core group of 10), acquisition of equipment and appointment of consultants. Thus, while some segments are into their second year, others have been gathering data for barely a year. At present all segments are fully operational, actively gathering and analysing data. The report of the Study is due at the end of June 1979. Rather than wait until the definitive report is available, the Steering Committee decided that a review of progress should be issued at this stage. As material is still being collected, analysed and interpreted, such an interim report describes what is being done rather than attempts to draw conclusions or consider options for multiple purpose use of the Sound's resources.

Recreation

High priority was given to surveying present recreational activities in the Sound and projecting future needs. The recreational survey is being carried out by Mr. John Griffiths of Feilman Planning Consultants Pty. Ltd., working in conjunction with the rest of the Study team. Liaison has been maintained with the Community Recreation Council as well as with local government authorities.

Field surveys have been made of the numbers of people using each section of the foreshore or the waters for various forms of recreation. More than 4,250 beach users and nearly 1,700 boat owners have been interviewed to gain more information and to assess attitudes. Meetings and correspondence with clubs and other organisations have provided further material on activities ranging from yachting to horse training.



Boating enthusiasts can still enjoy the protected waters of Cockburn Sound.

Data gathered from this survey are being compared where possible with levels of recreational activities in other areas so that these uses of the Sound can be put into perspective. Field work has now been completed and the data are being assessed for a report.

Fish Production

The importance of the Sound for fish production (including crabs and mussels) has not been assessed previously. A significant part of the catch may be taken by amateur fishermen, linking this segment of the Study with the survey of recreational activities. The Sound has a role as a breeding or nursery area, possibly for stocks fished elsewhere.

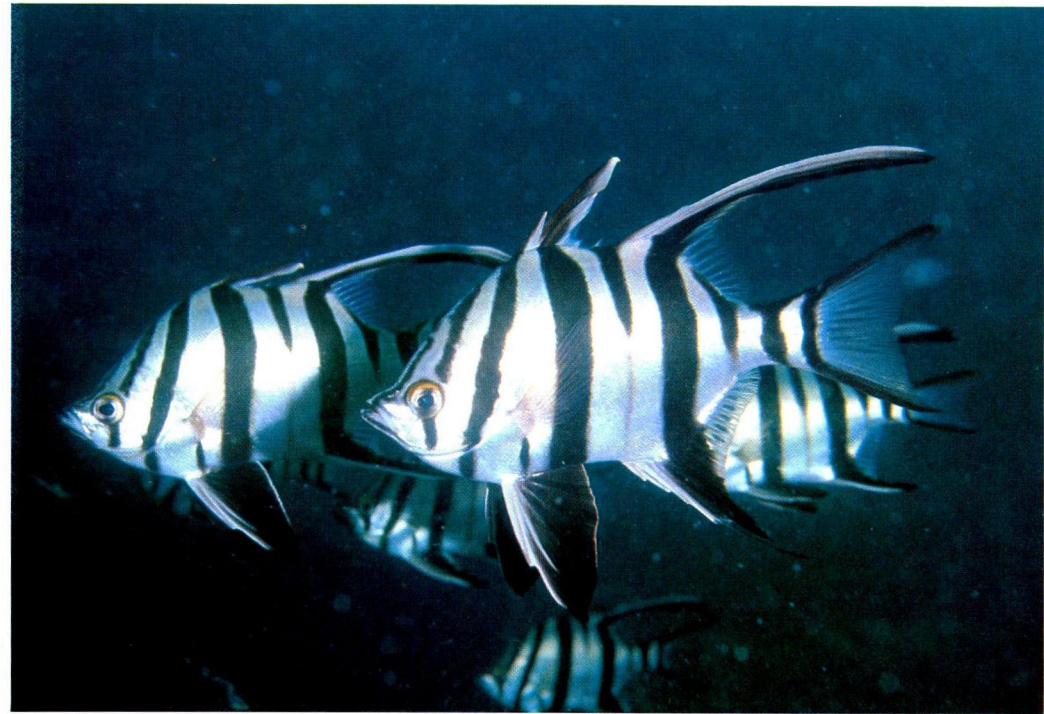


The blue manna crab is caught from Cockburn Sound in large numbers by both amateur and professional fishermen.

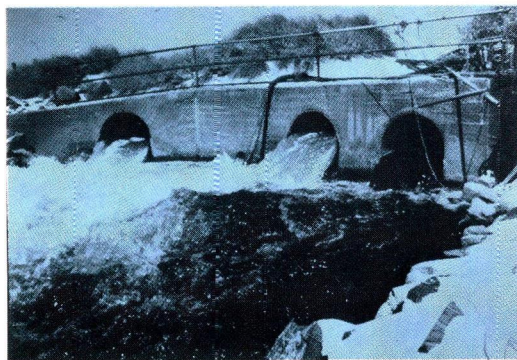
Dr. John Bass commenced this work in close association with fisheries scientists of the Department of Fisheries and Wildlife. When Dr. Bass left in October 1977 to take up a permanent position in New Zealand Mr. Rand Dybdahl joined the Study Group as fish ecologist to continue the programme.

Regular sampling is being carried out throughout the Sound using a variety of nets to cover the range of habitats available. A creel census is continuing; fishermen returning to shore are being asked how long they fished, what was caught and where.

In the limited time available it is not possible to study all the fauna of the Sound and to establish many of the links in the food web of this marine community. However, scientists at the Western Australian Museum carried out a useful survey some 20 years ago of the species on the bed of the Sound. This material is now being up-dated by the Museum staff and may give some insight into the present status of the bottom living fauna.



An attractive species of fish encountered in Cockburn Sound. These fish are commonly known as Old Wives.



Effluent being discharged directly into Cockburn Sound.

Direct Discharge

Industries and instrumentalities discharging directly into these waters are cooperating in the Study by supplying information on water usage, processes, rates of discharge and constituents monitored by their own laboratories. The Study Group also carries out its own sampling of effluents. The Government Chemical Laboratories and private analysts have assisted in the analysis of the samples.

On occasions round-the-clock sampling is continued for several successive days to record quantities of metals and nutrients (various forms of nitrogen and phosphorus) present in effluents. Attention is now being given to residues of hydrocarbons and other organic compounds.

The effluents being piped into Owen Anchorage from the meat, fish, hides and woollscouring trades are also being analysed for organic residues, bacteria, metals, etc. A consultant sanitary engineer has been appointed to study the feasibility of pumping these organic wastes to Woodman Point for further treatment. The Metropolitan Water Supply, Sewerage and Drainage Board is supporting the study by analysing the wastes involved.

Effluent Input

An essential step toward management of the Sound for multi-purpose use is the recording of the quantities and chemical composition of urban and industrial discharges entering these waters either directly or by way of groundwater or atmospheric fallout.

Dr. Peter Murphy of the Department of Industrial Development is responsible for this segment of the Study with support from the core group.

Groundwater

The location and depths of 110 bores already sunk around the Sound have been established and samples are being taken from 36 selected sites for analysis of water quality. In addition, 9 observation bores are being drilled so that stratified sampling may be carried out by groundwater consultants at depth intervals through the aquifer. Some industries are meeting the cost of observation bores on their properties as they are also interested in the quality of the groundwater.

Air Emissions

Air emissions are not included in the Cockburn Sound Study as they are of greater relevance to urban development than to the Sound itself. These are being considered by the Kwinana Air Modelling Study (KAMS).

Effluent Impact

Algal Blooms

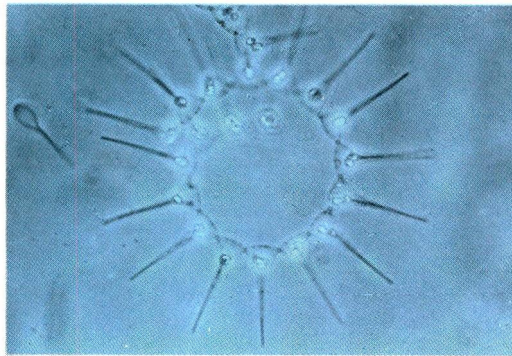
From time to time there have been complaints of algal blooms making waters and beaches less attractive. The question of whether effluents are enriching the waters of the Sound and increasing the frequency or intensity of the algal blooms is being studied by Mr. Tony Chiffings of the Cockburn Sound Study Group supported by the Department of Botany, University of Western Australia.

The patterns of distribution of nutrients in the Sound are being measured through all seasons of the year. The density of phytoplankton (minute plants suspended in the water) is being measured and the important types identified. Bioassays are being carried out to determine which factors normally limit algal blooms. Knowledge of the water circulation is important in assessing the dispersion of nutrients discharged at a given point and the removal of nutrients by the flushing action of storms.

Bacteria

Certain of the discharges contain bacteria of animal or human origin. Most of these soon die in the sea, especially when exposed to sunlight. In order to check on the extent of survival and dispersion of these bacteria, the Study Group is co-operating closely with the Public Health Department.

Samples of seawater and mussels are taken regularly from selected localities for examination in that Department's bacteriological laboratory.



One of the microscopic plants causing algal blooms.

Metals, Hydrocarbons and other Chemicals

The fate of these substances upon entering the Sound depends partly upon water circulation and rate of exchange with the ocean, and partly upon chemical or biological activity which may either concentrate them in surface sediments or pass them along food chains.

The Study Group's marine chemist, Mr. Trevor Brown is mapping the distribution of metals in the sediments of the Sound. Selected species of plants, worms and shellfish are being analysed to determine whether significant quantities of these metals are accumulating in tissues. Murdoch University has made available the use of highly specialised equipment and is also undertaking a wider investigation of heavy metals in fish.

Samples are being analysed to see which hydrocarbons are present and whether they have toxic or tainting effects. The Western Australian Institute of Technology is co-operating here, having developed techniques for separating and identifying hydrocarbons.

Water Circulation

While planning and building the causeway to Garden Island, the Commonwealth Department of Construction investigated the rates of exchange of water between the Sound and the ocean under a range of conditions.

The present Study is seeking more information on the fine structure of water circulation within the Sound

Seagrass

Seagrass, once plentiful in shallow waters around the Sound, has declined considerably since 1957, disappearing from much of the eastern shore. Studies in various parts of the world have underlined the important role played by seagrasses as a basic unit of the plant and animal community and also in binding and holding sediments. Recession of seagrass is therefore viewed with some concern.



A declining Seagrass meadow photographed in Cockburn Sound.

under various meteorological and oceanographical conditions. This will help in determining where discharged effluents will be carried and dispersed. The work is being carried out by Dr. Ray Steedman of R. K. Steedman and Associates, with field assistance from the core group. Actual observations on weather and ocean conditions are being applied to a computer model to simulate circulation within the Sound. Weather data of recent years are being analysed to determine the frequency of storm conditions which are responsible for flushing the Sound.

Miss Marion Cambridge of the Department of Botany, University of Western Australia, assisted by the core group, is mapping the present distribution of the seagrasses, measuring the vigour of the remaining meadows, and studying the requirements of the various species for optimum growth. Tests are being carried out under controlled conditions to determine which of the substances being discharged into the Sound may be toxic to seagrass seedlings.



A healthy, flowering seagrass meadow in Warnbro Sound, the 'control' area for the Study Group's seagrass investigation.

Sediment Transport

The present configuration of the Sound and adjacent banks is the result of sedimentary processes which have been operating since a rise in sea level cut off Garden Island 7,000-8,000 years ago. While some movement of sediments continues with erosion in certain areas and accretion in others, rates of transport of sediments in the Sound appear to be lower than on more exposed coastlines.

With considerable development taking place in the Sound the question arises whether the man-made changes are affecting sediment movements significantly. This is difficult to answer in a short-term study since much of the sediment movement takes place during severe storms which are of low and variable frequency. Mr. Roy France of the Department of Geology, University of Western Australia has been studying the processes involved in the formation of beach platforms and submerged banks



Beach erosion cutting into vegetation on the north side of James Point.

around the Sound. An understanding of these processes is basic to forecasting the effects of new developments.

Submerged pickets driven into the sediment are being used by the Study Group to measure the rates of movement of sediment across banks.

The Commonwealth Department of Construction is monitoring beach profiles in the southern portion of the Sound and on Garden Island.

Dr. Bill Andrew of the Harbours and Rivers Branch, Public Works Department, is using aerial photographs as an aid in assessing long term changes in the foreshore to the south of Fremantle.

The stability of coastal dunes around the Sound and on Garden Island has been examined by Mr. John Grasby of the Soil Conservation Service, Department of Agriculture. Areas sensitive to wind erosion are being defined.

Overall Progress

Peak activity of the Study continues through 1978. Various segments overlap or support each other so that there is a need for close integration in order to make the best use of the information being assembled. A wide range of departments, institutions and consultants are participating or giving assistance.

Direct expenditure on the Study by the Government is expected to total \$613,000. The programme has concentrated upon those aspects necessary to enable options for management of the Sound for multi-purpose use to be assessed.

The final report of the Study will mark the end of one phase only; the identification of problems and ways in which they may be resolved. In the implementation of a management plan there will be a need for monitoring, not only of effluents to maintain standards, but also of the environment of the Sound to ensure that the desired results are being achieved.

For further information contact Liz Moore, telephone 3358522, Cockburn Sound Study Group.

