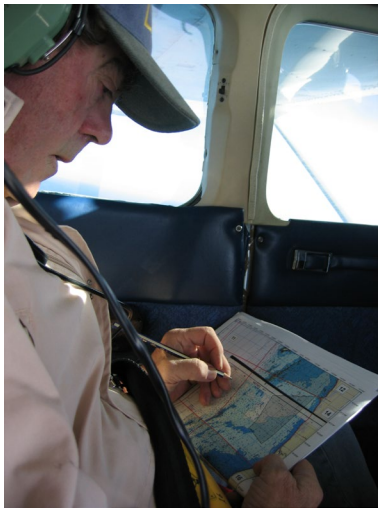

HUMAN USAGE MONITORING PRGRAM:

Jurien Bay Marine Park
Human Usage Data 2004

Department of Conservation and Land Management
Data Report: MMS/CWC/JBMP-85/2005

March 2005

Government of Western Australia
Department of Conservation and Land Management
Conserving the nature of WA
Natural Heritage Trust
Helping Communities Helping Australia
nacc

MARINE MANAGMENT SUPPORT
MIDWEST REGION

HUMAN USAGE MONITORING PROGRAM:

Jurien Bay Marine Park Human Usage Data 2004

Report: MMS/CWC/JBMP– 85/2005

Prepared by
T Grubba, L Butcher and K Fitzgerald

March 2005

ACKNOWLEDGEMENTS

Direction
Manager, Marine Conservation Branch (MCB), CALM - Dr Chris Simpson
Section Leader - Marine Management Support, MCB, CALM – Dr Nick D' Adamo
Section Leader – Marine Information Section, MCB, CALM – Ray Lawrie

CALM Regional/District collaboration
District Manager, Moora District (MD), CALM – Keith Hockey
Marine Park Coordinator, MD, CALM – Kevin Crane
Marine Conservation Officer, MD, CALM – Lee Butcher
Portfolio Leader – Monitoring, MCB, CALM – Tim Grubba
Marine Ecologist, MCB, CALM - Kevin Bancroft
Marine Conservation Officer, MCB, CALM – Kate Fitzgerald
Marine Community Monitoring Officer, MCB, CALM – Karen Wheeler
Marine Information Officer, MCB, CALM – Mark Sheridan
Marine Information Officer, MCB, CALM – Philip Kindleysides

Funding / Resources
This project is a sub-program of the "Central West Coast Marine Biodiversity and Conservation Program" conducted by the Marine Conservation Branch, Moora District of CALM and Northern Agricultural Catchment Council with part funding by the Northern Agricultural Region of the Natural Heritage Trust 2.

This report may be cited as:

Grubba T, Butcher L and Fitzgerald K. (2005). Human Usage Monitoring Program: Jurien Bay Marine Park Human Usage Data 2004. Report MMS/CWC/JBMP-85/2005. March 2005. Marine Conservation Branch, Department of Conservation and Land Management, Perth, Western Australia. (Unpublished report).

Copies of this report may be obtained from:

Marine Conservation Branch
Department of Conservation and Land Management
47 Henry St., Fremantle, Western Australia, 6160

Ph: (08) 9336 0100
Fx: (08) 9430 5408

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREAMBLE

The Central West Coast (CWC) marine bioregion (IMCRA, 1997) extends for about 600 kilometres, from Trigg Island to Kalbarri. The CWC marine bioregion is a zone of biogeographical overlap between the warm tropical waters of northwest Australia and the cool, temperate waters off the south coast of Western Australia. The marine and coastal environs of the CWC marine bioregion comprise a unique combination of offshore reefs, islands and sheltered lagoons. The marine biota of the bioregion comprises of an unusual mix of tropical and temperate species and includes many endemic species. The CWC marine bioregion contains more seagrass species than any other marine bioregion in Australia (Larkum & Hartog, 1989).

Located within the CWC marine bioregion, the Jurien Bay with its pleasant Mediterranean climate, ease of accessibility from the Perth metropolitan area, sheltered lagoonal waters, natural sites and diverse and abundant fauna and flora make it a popular destination for people who use the area primarily for recreational fishing-based activities but also a variety of water-based activities (e.g. SCUBA diving, surfing, snorkelling) and coastal and island based activities (e.g. beach activities and camping). The region is also becoming increasingly urbanised with planned residential infrastructure development. The region maintains a commercial importance as a focal point for commercial western rock lobster fishing, which has the highest economic value of any single species commercial fishery in Australia.

The State Government under the 1998 policy document *New Horizons The Way Ahead In Marine Conservation and Management* (Government of Western Australia, 1998) and the report of the Marine Parks and Reserves Selection Working Group, *A Representative Marine Reserve System for Western Australia* (MPRSWG, 1994) identified the need to adequately represent the CWC marine bioregion limestone reef system a major ecosystem with the bioregion through the creation of the Jurien Bay Marine Park in 2003. The Park is located 200 kilometres north of Perth and extends from Wedge Island to Green Head. The JBMP was created as a multiple use marine park to primarily ensure conservation of the area's biodiversity while managing the area for recreational and commercial activities.

The JBMP is the State's first marine conservation reserve to adopt a best practice out-come based marine management system built around a number of key overarching management strategies as defined in the *Jurien Bay Marine Park Management Plan (2004 – 2014)* (CALM, 2005), annual work plans, and a performance assessment framework (MPRA, 2002 and CALM, 2005 - draft).

The data presented in this report were collected as part of the JBMP Human Usage Monitoring Program which is being developed and implemented to meet the social information requirements of the performance assessment reporting framework, as identified in the *Jurien Bay Marine Park Management Plan (2004 – 2014)* (CALM, 2005) and summarised in Tables 1 and 2. The collection of this data has also assisted in the development of monitoring procedures that will be included in the draft Manual of Standard Operations Procedures (SOP) (Grubba *et. al.,* 2005).

While this report reviews a number of programs that currently collect social data relevant to the Jurien region, the acquisition of much of the data is pending the development of formal agreements being made in regards to program integration with the various custodians of the data.

Surveys conducted during 2004 indicate that the Jurien Bay area has a peak in human usage during the Easter long-weekend. Usage tends to be highest in camping areas, day use sites and in the vicinity of boat launching areas. However, nearly all marine park waters and adjacent coastline are subject to some level of usage. Activities in and adjacent to the park tend to be primarily extractive with high levels of commercial and recreational fishing for western rock lobster (using pots and taking by hand) and recreational fishing (beach and boat based). Recreational beach fishing is a major coastal activity and boat based fishing tends to focus on the deeper waters west of the park. Surveys conducted during Easter indicate that while fishing effort was high, the actual take of target fish (e.g. Dhufish) was relatively low.

Surveys identified that the majority of park visitors, particularly during Easter are from Perth and camp locally or stay in the Jurien or Cervantes town sites. Awareness of the park and multiple-use management is

high among visitors, although the majority had limited knowledge of the park boundaries and location of zones. Most visitors had a high level of awareness of the park's ecological values and the potential threats to them, and typically had gained this level of awareness and knowledge through brochures and other generic information sources.

Table 1 Summary reference table. Pressure indicators for ecological values identified in the *Jurien Bay Marine Park Management Plan (2004-2014)* (CALM, 2005).

Pressure indicators to be monitored	Ecological values potentially impacted										
	Geomorphology	Water quality *	Seagrass	Macroalgal communities	Intertidal reef platform communities	Seabirds and migratory waders	Invertebrate communities	Finfish *	Australian sea lions *	Cetaceans & turtles	SOP Manual Section/s
PASSIVE ACTIVITIES											
Vehicles											
Number on beaches	■										
Number on coastal tracks	■										
Number with boat trailers							■	■			
Number of campsites	■										
People											
Number on the beach	■										
Number in dune areas	■										
Number on island beaches						■			■		
Number in intertidal areas					■		■				
Water based activities											
Number of recreational vessels		■	■	■		■	■	■	■		
Number of commercial vessels		■	■	■		■	■	■	■		
EXTRACTIVE ACTIVITIES											
Target invertebrate species											
Annual commercial catch					■						
Annual recreational catch					■						
Annual take of specimens					■						
Commercial fishing effort					■						
Recreational fishing effort					■						
Non-target invertebrate species											
Annual commercial catch							■				
Annual recreational catch							■				
Target finfish species											
Annual commercial catch								■			
Commercial fishing effort								■	■		
Recreational fishing effort (boat-based)								■	■		
Recreational fishing effort (shore-based)								■	■		
Non-target finfish species											
Annual commercial catch								■			
Annual recreational catch								■			
Commercial fishing effort								■			
Recreational fishing effort								■			

Table 2 Summary reference table. Pressure indicators for social values identified in the *Jurien Bay Marine Park Management Plan (2004-2014)* (CALM, 2005).

Pressure indicators and performance measures to be monitored	Social values potentially impacted												SOP Manual Section/s
	Indigenous heritage	Maritime heritage	Commercial fishing	Aquaculture	Coastal use *	Seascapes 8	Recreational fishing	Water sports	Marine nature-based tourism	Petroleum drilling & mineral develop	Scientific research	Education	
PASSIVE ACTIVITIES													
Vehicles													
Number on beaches					■								
Number on coastal tracks					■								
Number with boat trailers			■				■						
Camping													
Number of campsites	■				■								
People													
Number on the beach	■												
Number in dune areas	■				■								
Number on island beaches					■								
Number on islands					■								
Number in intertidal areas					■		■						
Water based activities													
Number of recreational vessels		■					■	■					
Number of commercial vessels			■										
EXTRACTIVE ACTIVITIES													
Target invertebrate species													
Annual commercial catch			■										
Annual recreational catch							■						
Annual take of specimens							■						
Commercial fishing effort			■										
Recreational fishing effort							■						
Non-target invertebrate species													
Annual commercial catch			■										
Annual recreational catch							■						
Target finfish species													
Annual commercial catch													
Commercial fishing effort			■										
Recreational fishing effort (boat-based)							■						
Recreational fishing effort (shore-based)							■						
Non-target finfish species													
Annual commercial catch			■										
Annual recreational catch							■						
Commercial fishing effort			■										
Recreational fishing effort							■						

1 INTRODUCTION

1.1 BACKGROUND

1.1.1 Western Australian Marine Conservation Reserve System

The Government of Western Australia is establishing a comprehensive statewide system of marine conservation reserves (MCRs) to preserve representative and special marine ecosystems and to ensure that the various uses of MCRs are managed in an equitable, integrated and sustainable manner (WA Government, 1994). As of 2005, twelve MCRs have been gazetted:

1. Rowley Shoals Marine Park;
2. Montebello Islands Marine Park
3. Barrow Islands Marine Park
4. Barrow Islands Marine Management Area;
5. Ningaloo Marine Park (including new extensions);
6. Murion Islands Marine Management Area;
7. Shark Bay Marine Park;
8. Hamelin Pool Marine Nature Reserve;
9. Jurien Bay Marine Park;
10. Marmion Marine Park;
11. Shoalwater Islands Marine Park; and
12. Swan Estuary Marine Park.

Western Australia's MCRs are vested (i.e. legally entrusted) in the Marine Parks and Reserves Authority (MPRA). The Department of Conservation and Land Management (CALM) is responsible for the overall management of MCRs under the provisions of the *Conservation and Land Management Act 1984* and for implementation of approved management plans. The Department collaborates with other agencies that have responsibilities within and adjoining MCRs, including the Department of Fisheries (DoF) and the Department for Planning and Infrastructure (DPI).

1.1.2 Marine Conservation Reserve Marine Management System

In 2000, the MPRA and CALM adopted a new best-practice outcome-based marine management system which is consistent with the Australian and New Zealand Environment Conservation Council (ANZECC) report *Best Practice in Performance Reporting in Natural Resource Management* (ANZECC, 1997). This new type of marine management system incorporates management plans that identify management targets and management strategies and a performance assessment reporting framework as described in the MPRA Audit Policy (2002) and framework paper currently being drafted by CALM. This system facilitates the adaptive management of MCRs by incorporating the outcomes of performance assessment reporting into the development and implementation of strategies to achieve management objectives.

Management plans

CALm MCR management plans which now follow best practice management principles and the *Jurien Marine Park Management Plan (2004-2014)* (CALM, 2005) was the first plan to be developed using this format. The management plans clearly identify the park's ecological and social values (Table 3) and clearly documents the objectives, major pressures, management targets and trends associated with each value. Management strategies are also specified to avoid or mitigate identified pressures or remediate the impacts of past pressures. The values are prioritised based on a value risk assessment (Simpson *et. al*., 2002). Values identified as having highest conservation values (from biodiversity and ecosystem integrity perspectives) are referred to as Key Performance Indicators (KPIs). In addition management strategies are also prioritised partially on the risk assessment process and also on the effectiveness of strategies to manage pressures and conserve and improve the condition of a value.

Table 3 Jurien Bay Marine Park values

ECOLOGICAL VALUES	SOCIAL VALUES
Geomorphology	Indigenous heritage
Water quality	Maritime heritage
Seagrass	Commercial fishing
Macroalgal communities	Aquaculture
Intertidal reef platform communities	**Coastal use**
Seabirds and migratory waders	Seascapes
Invertebrate communities	Recreational fishing
Finfish	Water sports
Australian sea lions	Marine nature based tourism
Cetaceans and turtles	Petroleum drilling and mineral development
	Scientific research
	Education

Values in bold have Key Performance Indicator.

Annual work plans

Annual work plans are an adaptive and operational interpretation of the management plan. They identify priority strategies and, include modified or new management strategies as required. Work plans are divided into the seven generic management strategies: administration framework, education and interpretation, public participation, surveillance and enforcement, intervention, research, and monitoring. Work plans also provide details on resources that are budgeted to each strategy.

Performance assessment reporting

A performance assessment reporting framework is currently being developed by CALM (Lloyd *et. al.,* 2003 – draft) and the MPRA (MPRA, 2002) to ensure that the objectives and management targets specified in the management plan for each MCR are being met. The performance assessment reporting framework is based around the Pressure-State-Response (PSR) model developed by the Organisation for Economic Co-Operation and Development (OECD). This framework provides a structure for assessment and reporting of key ecological and social values of the reserve, park-wide strategic objectives, and whole of marine reserve system assessment. The MCR performance assessment framework can also make a valuable contribution to 'state of the environment' reporting at the State and national level.

The performance assessment framework developed by CALM and the MPRA consists of three tiers. The first tier is annual performance reviews conducted within CALM (but also reported to the MPRA), focusing primarily at a value and park level. Statutory triennial audits conducted by the MPRA, focusing on key performance indicators and are based on the three preceding annual performance reviews conducted by CALM. The third tier is the statutory ten year review of management plans and are based on the preceding ten annual perform reviews and three triennial audits.

Periodic third-party audits are a critical component of "best-practice" management as the evaluation provides the basis for an adaptive management approach designed to avoid, mitigate or remediate human impacts on the environment.

Monitoring and research programs

To meet requirements of performance assessment reporting for the JBMP, CALM must provide information on ecological and social values (as per the management plan) using the Pressure, State and Response model. This requires the development, implementation and maintenance of research and monitoring programs that provide information on pressures impacting values, the condition of values and the nature and effectiveness of management response in managing pressures and improving value condition.

1.2 OBJECTIVES

The objective of the JBMP Human Usage Monitoring Program (HUMP) is to collect information on the types, spatial patterns and temporal trends of visitor activities in the JBMP to meet the performance

assessment reporting and management requirements of the JBMP as identified in the *Jurien Bay Marine Park Management Plan (2004-2014)* (CALM, 2005).

2 EXISTING METHODS AND PROGRAMS

A variety of existing programs (within and external to CALM) collect human usage information that is relevant to the management of WA MCRs. Methods are primarily based on recording the nature and spatial distribution of activities using direct observer observations and mechanical recording mechanisms or using questionnaires to record information on human knowledge/awareness, usage and attitudes. The information collected varies with regard to the variables that are measured and the resolution at which they are measured. While there is some level of integration of monitoring programs within CALM under the Vistat program (see below), limited integration occurs between some programs in CALM and programs external to CALM.

The following sections summarise a number of monitoring programs that can be used to collect information to meet the performance assessment reporting requirements for MCRs. Where possible, the monitoring programs presented in this Manual should be integrated with existing programs through the development of formal agreements which provide clear frameworks. While no formal agreements were reached during the development of the first version of the Manual, the current suite of methods included in the Manual is, wherever possible, consistent with the methods used by other programs.

2.1 CALM VISITOR INFORMATION STATISTICS (VISTAT) PROGRAM

The Visitor Information Statistics (VISTAT) program is a long-term program managed by CALM's Regional Parks Section, to provide management related information on visitor needs and expectations and on levels and patterns of use. Historically, the program has focused primarily on terrestrial reserves with only limited effort placed on information requirements of MCRs. Information related to MCRs was derived primarily from traffic counters, visitor numbers to information centers, ticket sales and licences issued.

Guidelines have been developed to assist implementation by CALM regions and districts (*Vistat 2000 Guidelines for the collection of visitor information data on CALM-managed lands and waters*, (CALM, 2000)). These guidelines require districts to develop their own data collection plans, while the VISTAT program maintains a web-based database that permits data entry and queries across the CALM intranet.

The HUMP and associated Manual must be integrated with VISTAT to facilitate CALM staff meeting the requirements of both programs. The Manual is consistent with the data collection protocols required by Vistat for MCRs.

2.2 MOORA DISTRICT, CALM

The Moora District is responsible for the management of the JBMP and adjacent terrestrial and island reserves. The District has developed a number of terrestrial focused human usage monitoring programs that meet the requirements of CALM's Vistat program. These programs include:

- Commercial operators – number of visitors per tour in the parks;
- Traffic counters – number of vehicles entering the national park;
- Payment records – for entry to and camping within the national park; and
- Questionnaires - visitor demographics, their level of satisfaction and the activities undertaken in marine and national parks.

2.3 WILDLIFE BRANCH, LICENCING SECTION, CALM

The Licencing Section, Wildlife Branch, administers and regulates all CALM licenced commercial operators (under the *Wildlife Conservation Act 1950*) whose activities involve marine wildlife throughout the state or occur within a MCR. The management of licences includes the collection of variety of human usage information from operator logbooks (submitted to CALM) that record trip details, passenger numbers, and wildlife interactions. In addition CALM collects a variety of data as part of the administration of licences and by undertaking surveillance and enforcement of commercial operators. The data collected by the Licencing Section is stored in a series of databases.

2.4 DEPARTMENT OF FISHERIES WESTERN AUSTRALIA

The Department of Fisheries (DoF) collects recreational and commercial fisheries information as part of its management of these activities in WA (under the *Fish Resources Management Act 1994*). Information is collected as part of licence conditions for commercial fisheries using catch return forms and during surveillance and enforcement operations. The information is collected and reported on using a 60 nautical mile grid system. Information on recreational fishing is collected using recreational boat fishing surveys (i.e. Creel survey) (Sumner and Williamson, 1999) conducted at boat ramps every few years and during surveillance and enforcement operations. The information is collected and reported on using a 5 nautical mile grid system. The grid systems used by DoF is considered to be at too broad a scale to address some key MCR information requirements and any future integration of CALM and DoF data would require the development of a sub-grid system for MCRs.

2.5 AUSTRALIAN CUSTOMS COASTWATCH PROGRAM

The Coastwatch program conducted by Australian Customs as part of its coastal surveillance activities comprises regular long-range surveillance flights in State and Commonwealth waters. All vessels are recorded and entered into an Australian Customs database managed by Australian Customs. CALM has obtained a copy of this database and is assessing its usefulness for management. The Department has liaised with Australian Customs to maximise management related data collection during the bi-weekly flights over the Rowley Shoals Marine Park.

2.6 JURIEN BAY VOLUNTEER SEA RESCUE GROUP

The Jurien Bay Volunteer Sea Rescue Group (JBVSRG) provides voluntary radio-based contact with recreational vessels in the region. JBVSRG record data on the vessel and passengers and the destination and types of activities undertaken. The information collected can be used to supplement management related information requirements.

2.7 DANDARAGAN SHIRE

The Shire of Dandaragan does not currently collect human usage data in the Jurien region. Recently, the Shire has taken on a direct role in the management of camping in the Sandy Cape Recreation Area through the introduction of fee-based camping, which will be regulated by Shire rangers. The CALM Jurien District office has recommended to the Shire that they collect a human usage data related to camping and activities conducted in the area and that this information should be made available to CALM.

3 CALM SURVEYS CONDUCTED IN 2004

Aerial surveys, all day observation surveys and a questionnaire were conducted during 2004 using methods described in the field program report *Human Usage Monitoring Program (HUMP): Jurien Bay Marine Park Aerial Survey, Observational Surveys and Visitor Questionnaire (Easter 9-12 April 2004)* (Grubba *et al*., 2004), to collect data to meet some of the information requirements for performance assessment reporting and management of the JBMP and to aid in the development of methods that are included in the *Manual of Standard Operations Procedures: Human Usage Monitoring Program Jurien Bay Marine Park* (Grubba *et al.,* 2005). A summary of the data collected is presented in the following sections. This data has been entered into and can be accessed through CALM's Marine Information System (MIS).

3.1 AERIAL SURVEYS

Six aerial surveys (Table 4) were conducted in the JBMP during 2004 using the method described in *Human Usage Monitoring Program (HUMP): Jurien Bay Marine Park Aerial Survey, Observational Surveys and Visitor Questionnaire (Easter 9-12 April 2004)* (Grubba *et al*., 2004). The data collected provides a "snap-shot" of the types and spatial patterns of human activities in the park and adjacent waters, islands and coastal strip from 9 am to 11 am..

Table 4 Summary of aerial surveys conducted in the Jurien Bay Marine Park during 2004

Survey Number	Date	Comments
1	11 April 2004 (Sunday)	Peak period – Easter long-weekend
2	19 June 2004 (Saturday)	Non-peak period
3	27 July 2004 (Saturday)	Peak period – July school holidays
4	04 September 2004 (Saturday)	Non-peak period
5	09 October 2004 (Saturday)	Peak period – October school holidays
6	20 November 2004 (Saturday)	Peak period – First week of the 2004/05 Rock lobster season

3.1.1 Results

Spatial patterns of human usage

Aerial surveys identified that human activities, such as boating and fishing, occur throughout the waters of the JBMP and that camping and day use activities occur along the adjacent coastal strip. Some activities such as fishing frequently occur in the deeper waters west of the park. Human usage tended to be highest in the vicinity of major access points at Green Head, Jurien and Cervantes and in the vicinity of recognised camping areas and shack communities.

Temporal patterns of human usage

Aerial surveys and local knowledge of the area identified that the period of highest usage of the Jurien Bay area occurs during summer and autumn when conditions are best suited for water-based activities. Within this period, peaks of activity occur during school and public holidays, in particular the Easter long weekend as identified by surveys conducted in 2004 (Figure 1). Holiday periods provide visitors, who predominantly originate from Perth, with the opportunity to make the 3-hour drive to the Jurien area. Given the relatively long travel time it is less likely that visitors would visit the Jurien area for a day trip or for a regular two-day weekend.

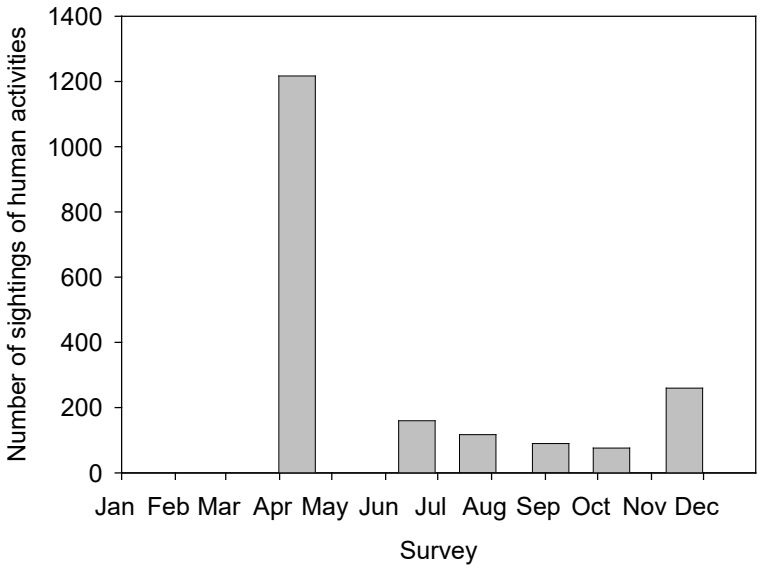

Figure 1 Number of incidents of human activities recorded during aerial surveys

Types of activities

The data collected during the six aerial surveys is presented in this report using a series of summary figures and tables. Figures 3 to 10 present the spatial distribution of seven major activities consolidated for all six surveys and Figures 16 to 58 present data for each individual survey. Tables 3 and 4 present a summary of the total number of recorded incidents of activities grouped in eleven major activity categories for each survey and Table 7 a summary for each monitoring sector.

Camping

Aerial surveys recorded a peak of 199 campsites, along the coastal strip adjacent to the park during Easter 2004. Particular concentrations of camping occurred at Sandland Island, Sandy Point and North Head (Sectors 6 and 8), while minor camping areas occurred in the vicinity of Hill River and Wedge Island. The number of campsites recorded during the other surveys times was relatively low with a maximum of 14 and a minimum of three on any day.

Charter vessels

Aerial surveys recorded a peak of seven commercial charter vessels in the park during Easter 2004, although only two local commercial charter vessels are known to regularly operate within the park. These two local commercial charter vessels were observed in the northern nearshore waters of the park during Easter and are likely to have been engaged primarily in passive activities (e.g. diving and wildlife viewing and interaction), while the other five charter vessels were located in the southern waters of the park, and were likely to have been engaged in fishing.

Motorbikes, personal water craft and people

Aerial surveys recorded the use of motorbikes and personal watercraft during most surveys. Motorbike use occurred primarily in coastal areas in large dunes adjacent to the park near Wedge Island. Personal watercraft usage appears to be limited and restricted to sites where craft can be easily launched such as Cervantes and Wedge Island. The numbers of people not associated with any specific activity was highest during Easter, and these people were concentrated in the vicinity of major coastal access points.

Recreational vessels

Aerial surveys recorded a peak of 191 recreational vessels in the park and an additional 34 vessels outside of the park during Easter 2004. An average of 23 vessels were recorded during the other aerial surveys. While vessel usage occurs throughout park waters, the concentration of boats diminished with distance from the major launch sites of Green Head (two ramps), Jurien boat harbour, Cervantes beach and Wedge Island beach. The data collected during the Easter aerial survey was ground-truthed using data collected by all day observational surveys conducted at the Green Head, Jurien and Cervantes boat launch sites (Section 3.2)

Western rock lobster fisheries

Aerial surveys collected data on the number and locations of commercial rock lobster vessels and rock lobster pots. A maximum of 53 commercial rock lobster vessels were recorded on any one survey. Aerial surveys did not distinguish between commercial and recreational rock lobster pots. Pot numbers were highest during the November survey, after the start of the 2004/05 rock lobster fishing season. This corresponds to a period when rock lobster numbers are greater in shallow near shore waters. Pot numbers declined in the two months prior to the end of the 2003/04 rock lobster fishing season, which is likely due to decreased fishing effort and the seasonal migration of rock lobsters offshore.

Vehicles and vehicles with boat trailers

Aerial surveys recorded a peak in vehicle numbers in coastal areas adjacent to park during Easter 2004. Vehicles were recorded on coastal tracks and on the beach along the entire length of coast adjacent to the JBMP. Vehicles with trailers were primarily recorded at the major boat launch sites, however a number of vehicles with empty boat trailers were recorded at camp sites indicating that small vessels are probably being launched at beaches adjacent to camping areas.

Marine wildlife

In addition to recording human activities the aerial surveys recorded the numbers and locations of humpback whales. A total of 26 humpback whales were sighted during the 2004 aerial surveys, with a total of nine humpback whales recorded during the July 2004 survey.

Table 5 Total numbers of incidents of human activities recorded during aerial surveys in the Jurien Bay Marine Park

Activity	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Charter Boat	7	0	1	2	2	0
Recreational Boat	191	13	27	24	22	36
Rock Lobster Boat	30	47	22	15	9	53
Rock Lobster Pots	342	297	0	0	0	816
Rock Lobster Tender boat	34	11	0	0	0	6
Total (excluding RL Pots)	**262**	**71**	**50**	**41**	**33**	**95**
Grand Total	**604**	**368**	**50**	**41**	**33**	**911**

Table 6 Total numbers of incidents of human activities recorded during aerial surveys outside the Jurien Bay Marine Park

Activity	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	199	4	3	10	9	14
Motorbike	8	11	3	0	4	13
Person	38	13	5	8	3	12
PWC	2	0	0	0	0	5
Recreational Boat	34	0	1	1	0	0
Rock Lobster Boat	4	0	1	1	0	0
Rock Lobster Pots	1	0	0	0	0	11
Rock Lobster Tender boat	0	0	0	0	0	0
Vehicle	439	20	32	20	18	80
Vehicle w boat Trailer	269	41	24	11	9	41
Total (excluding RL Pots)	**993**	**89**	**71**	**51**	**43**	**165**
Grand Total	**994**	**89**	**71**	**51**	**43**	**176**

Table 7 Total numbers of humpback whales recorded during aerial surveys

Activity	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Wildlife (whales)	0	0	19	3	4	0
Wildlife (whales)	0	0	2	0	0	0

3.1.2 Recommendations

A more complete pattern of annual human usage will require additional aerial surveys, particularly during the months of December through March, which were not surveyed in 2004. Several school and public holidays occur at this time and it could be expected that significant numbers of people will visit the area.

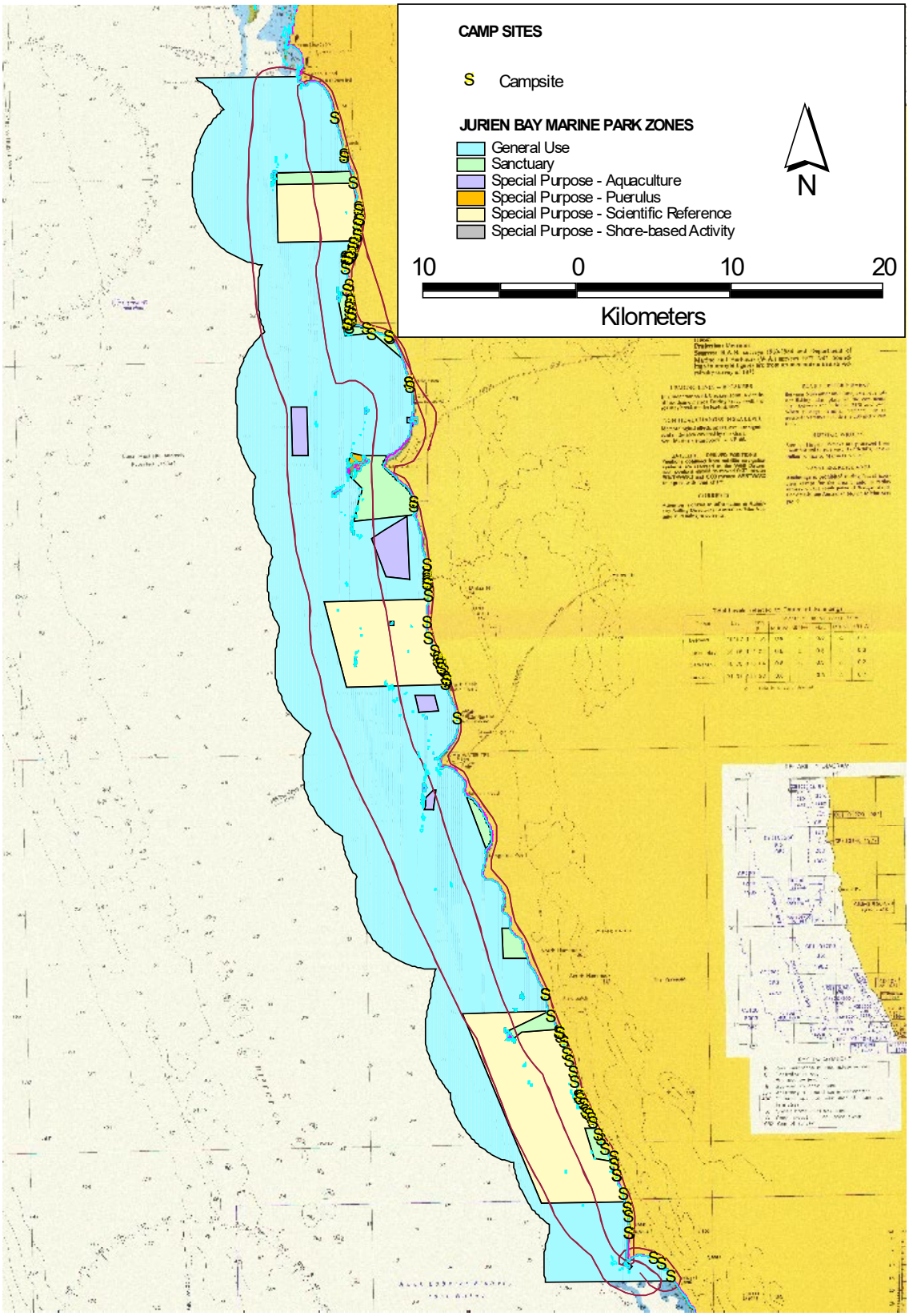

Figure 2 Distribution of campsites adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04, 19/06/04, 24/07/04, 04/09/04, 09/10/04 and 20/11/04

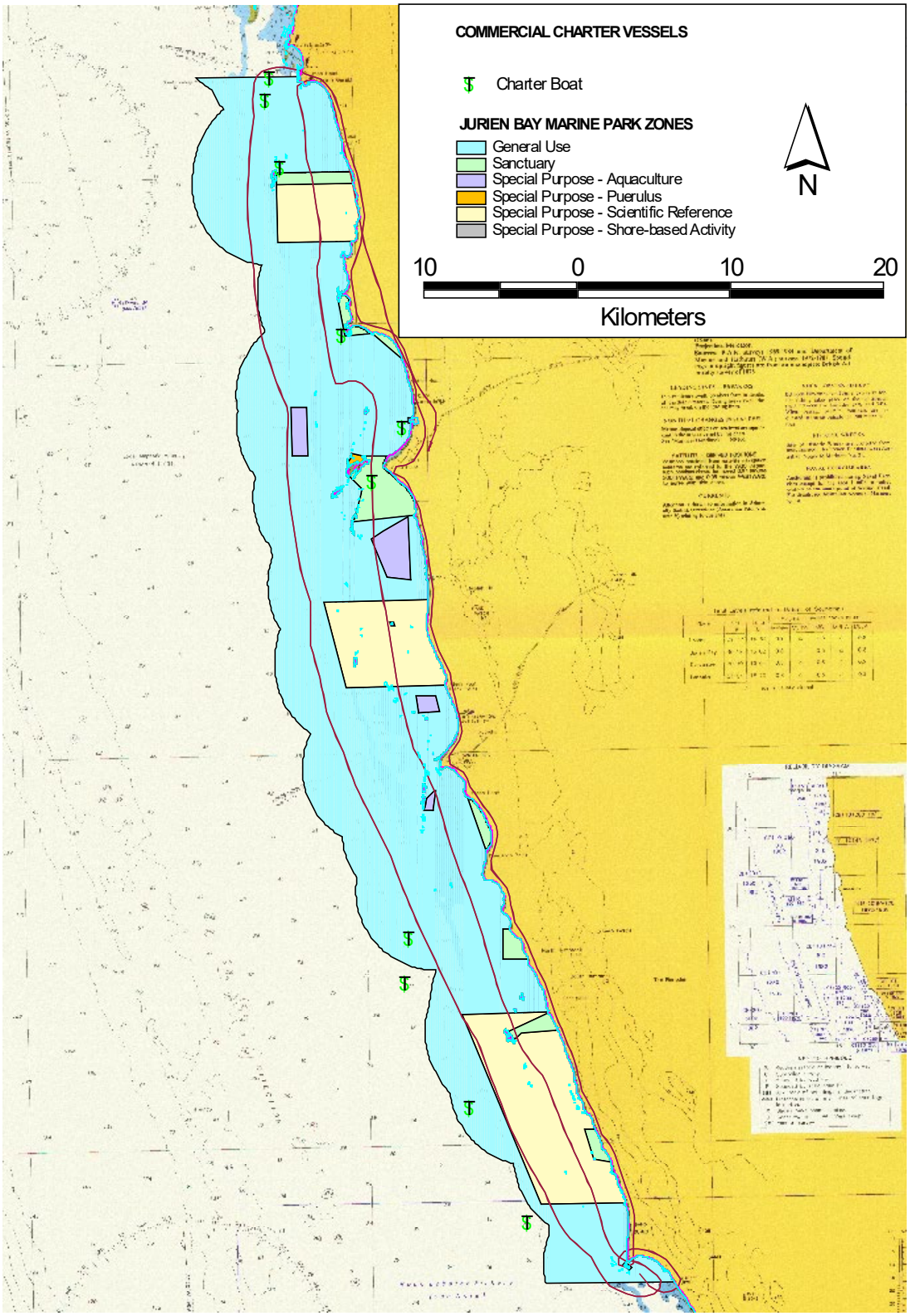

Figure 3 Distribution of commercial charter vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04, 19/06/04, 24/07/04, 04/09/04, 09/10/04 and 20/11/04

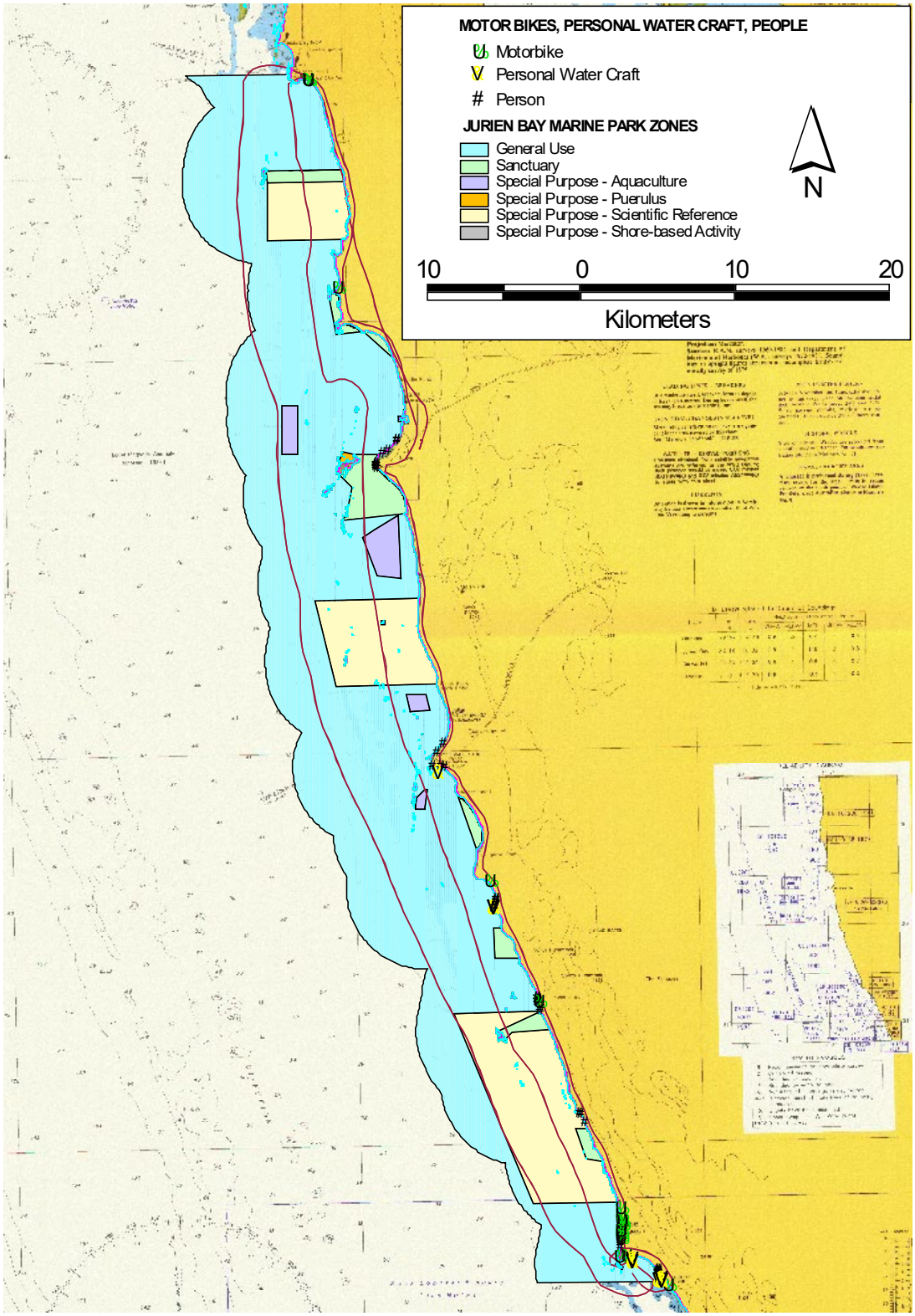

Figure 4 Distribution of motorbikes, people, and personal watercraft adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04, 19/06/04, 24/07/04, 04/09/04, 09/10/04 and 20/11/04

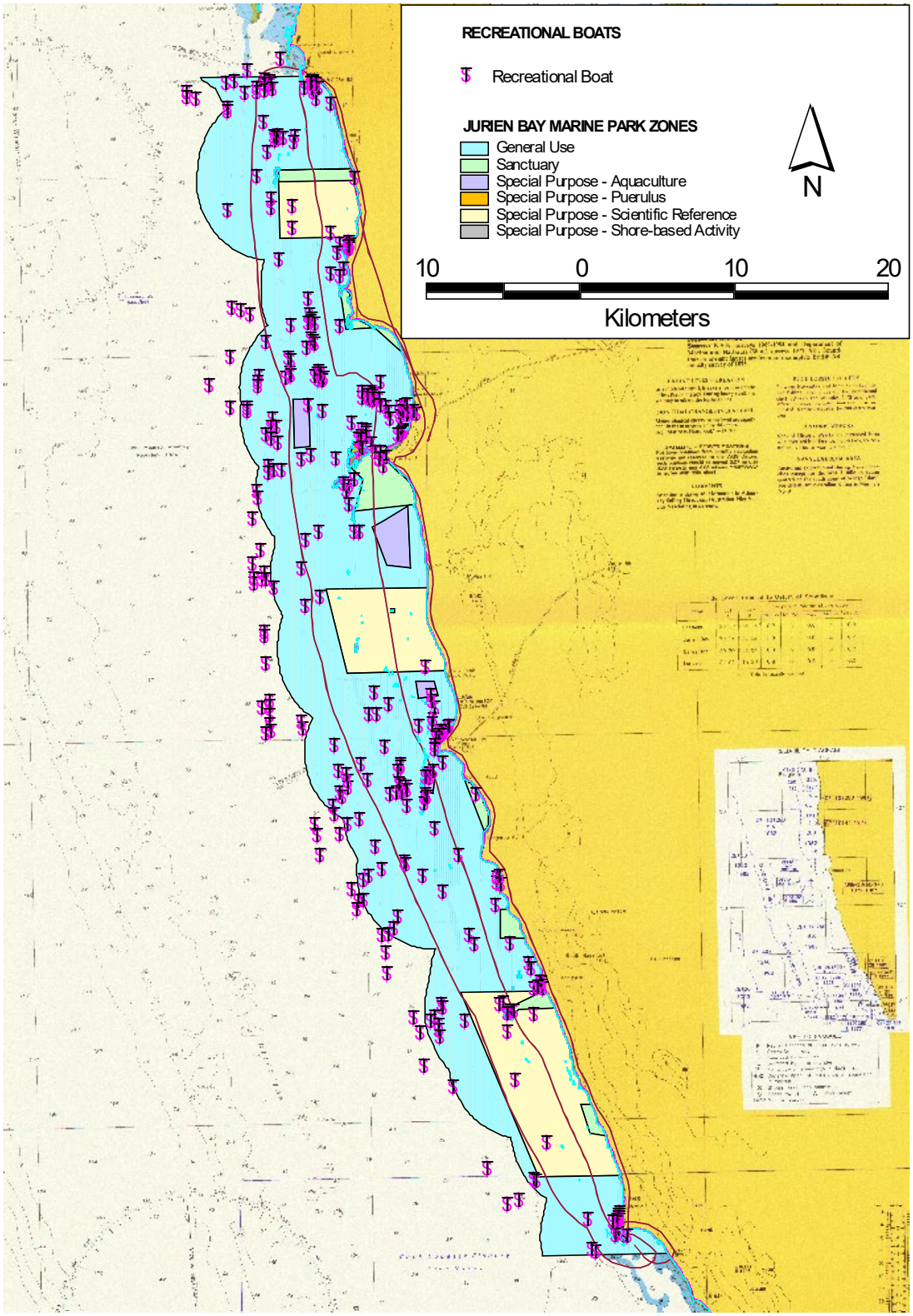

Figure 5 Distribution of recreational vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04, 19/06/04, 24/07/04, 04/09/04, 09/10/04 and 20/11/04

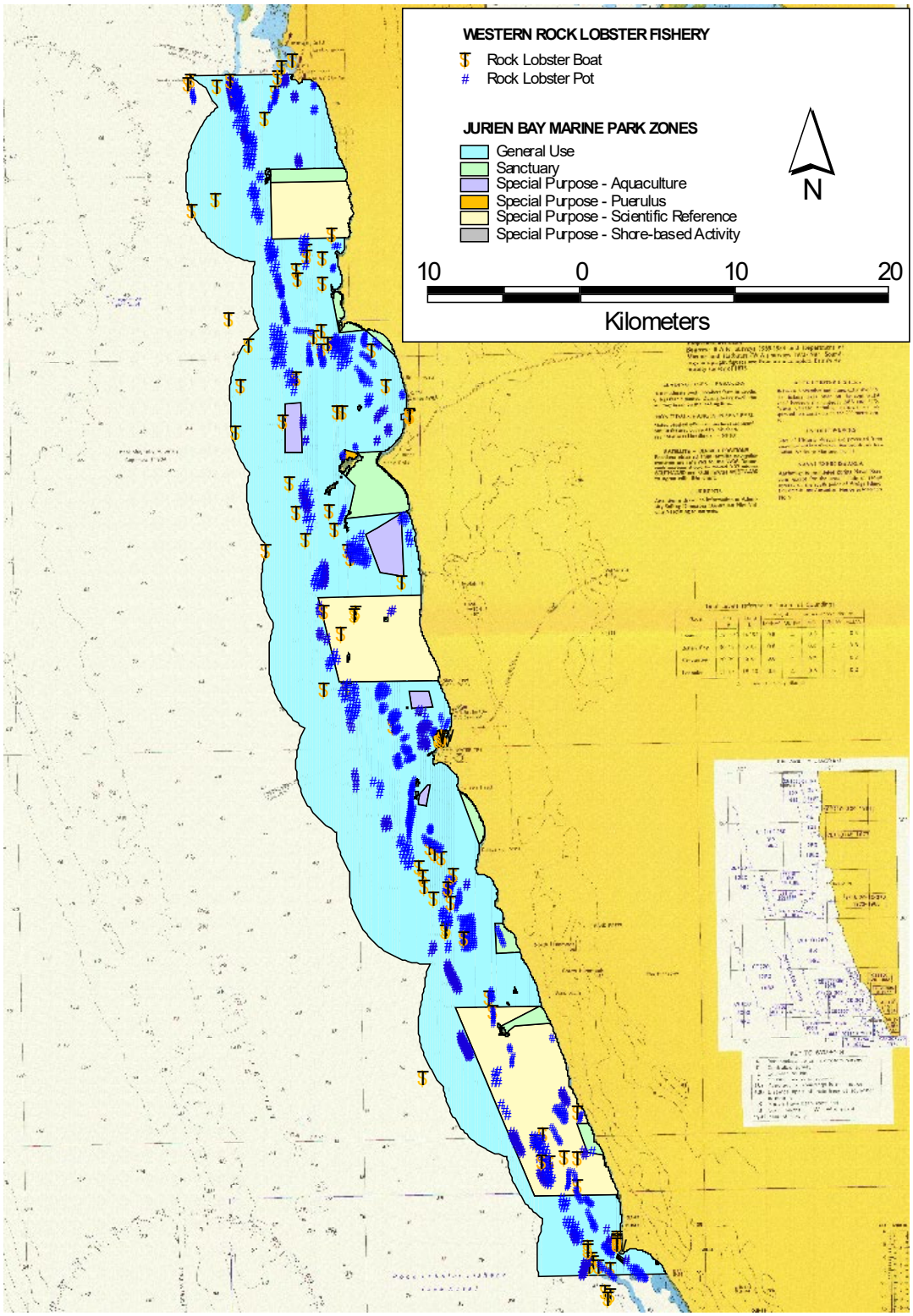

Figure 6 Distribution of commercial rock lobster vessels and pots adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04, 19/06/04, 24/07/04, 04/09/04, 09/10/04 and 20/11/04

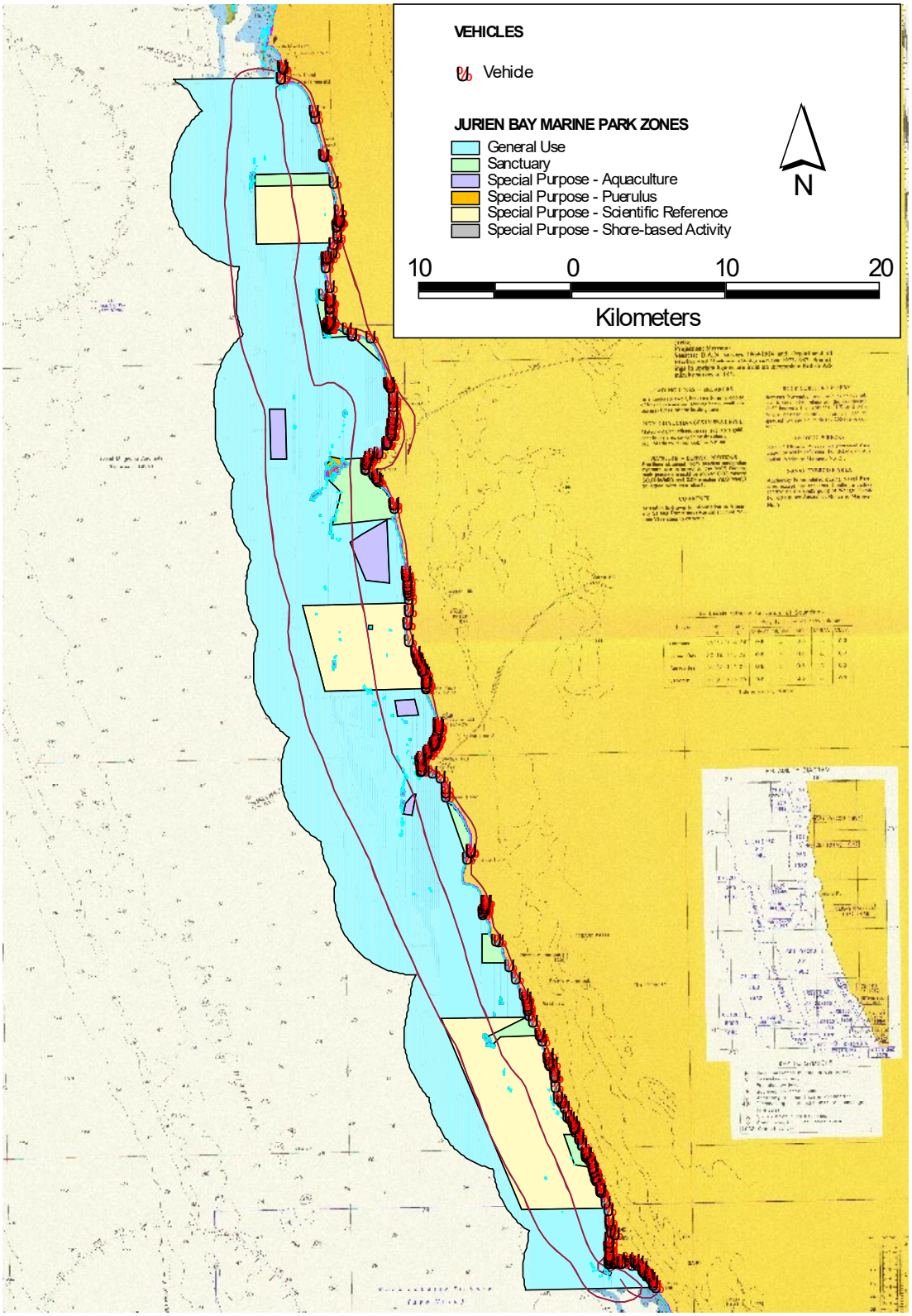

Figure 7 Distribution of vehicles adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04, 19/06/04, 24/07/04, 04/09/04, 09/10/04 and 20/11/04

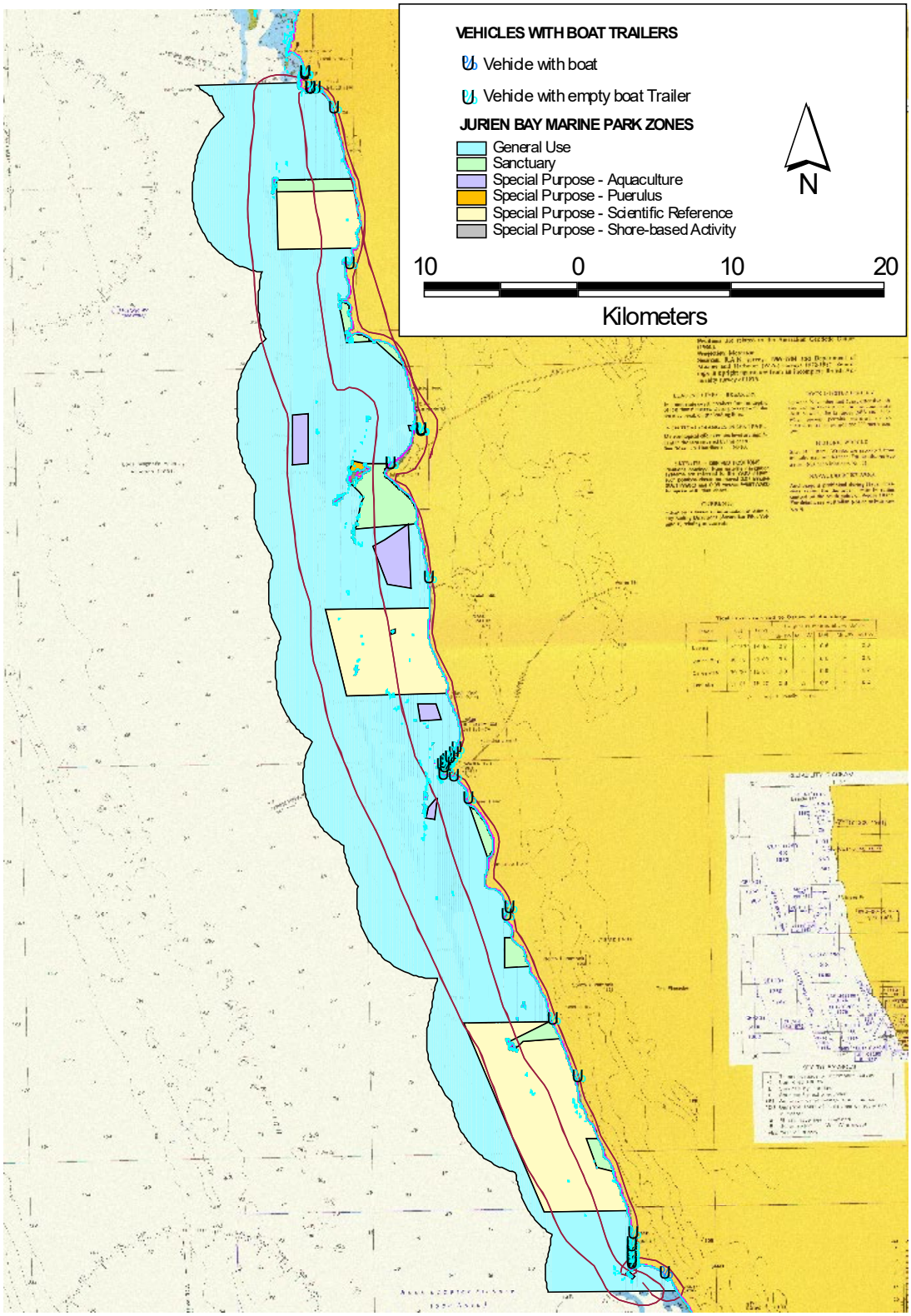

Figure 8 Distribution of vehicles with boat trailers adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04, 19/06/04, 24/07/04, 04/09/04, 09/10/04 and 20/11/04

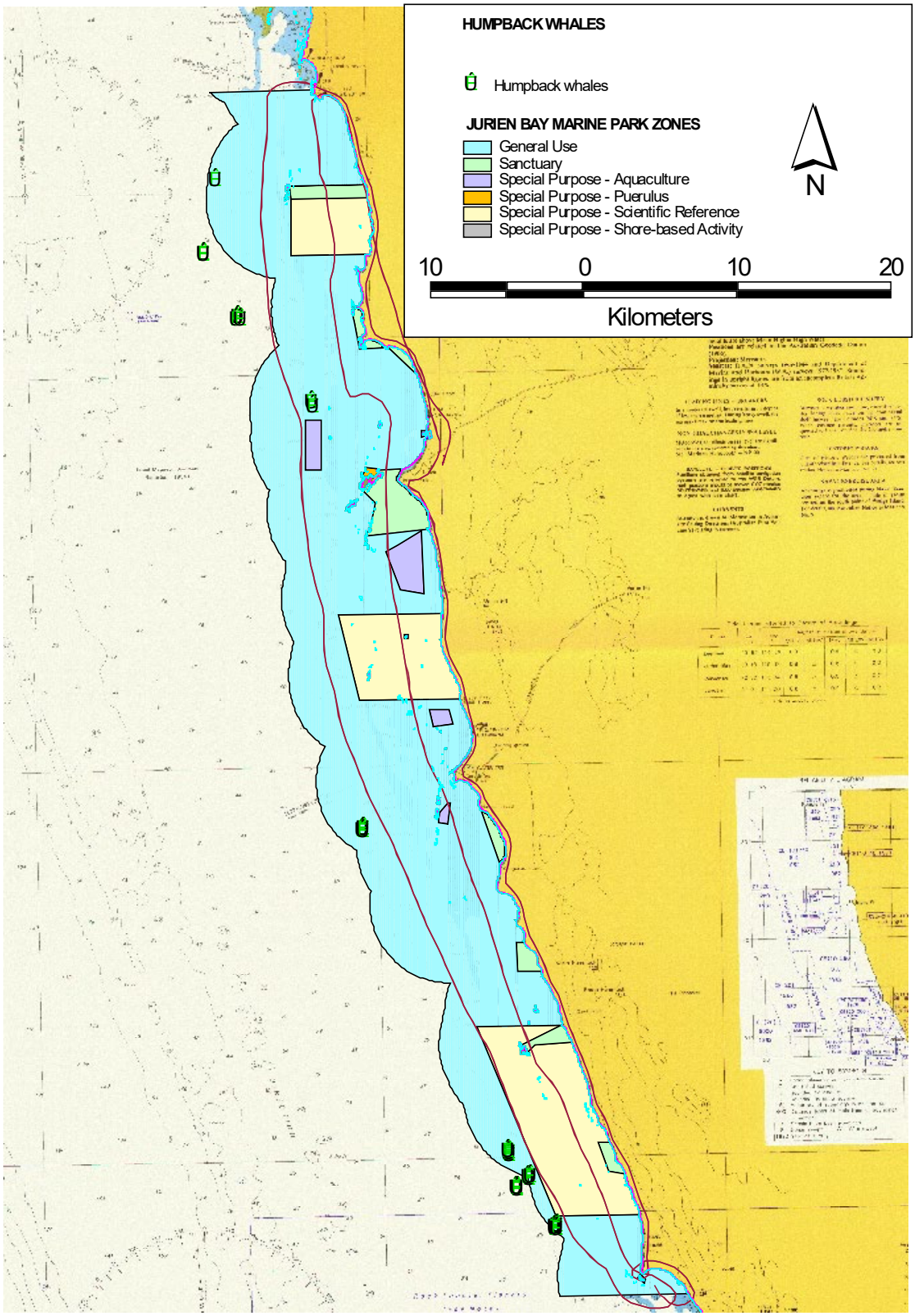

Figure 9 Distribution of marine wildlife adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04, 19/06/04, 24/07/04, 04/09/04, 09/10/04 and 20/11/04

3.2 ALL DAY OBSERVATION SURVEYS

At Easter 2004, all day observation surveys were conducted at Green Head, Jurien boat harbour and Cervantes beach. Which are the three major boat launching sites adjacent to the park. Surveys were implemented, using the method described in *Human Usage Monitoring Program (HUMP): Jurien Bay Marine Park Aerial Survey, Observational Surveys and Visitor Questionnaire (Easter 9-12 April 2004)* (Grubba *et al*., 2004). The data collected provides a "snap-shot" of the types, temporal (daily) and spatial patterns of vessel-based activities in the park. The all day observation surveys were conducted during the aerial surveys and can be directly compared to the aerial survey data.

3.2.1 Results

Vessel numbers

Weather and sea conditions throughout the day of the survey were considered ideal for water based activities. Vessel numbers at the three launch sites and adjacent waters peaked at 192 vessels between the hours of 10:30 and 10:45 (Figure 10). At the Green Head boat ramp (north) vessel numbers peaked at 33 vessels between the hours of 9:15 and 9:45 (Figure 11). At the Jurien boat harbour ramp vessel numbers peaked at 91 vessels between the hours of 10:00 and 11:00 (Figure 12). At the Cervantes Beach launching area vessel numbers peaked at 70 between the hours of 10:30 and 11:45 (Figure 13). At the conclusion of the survey a total of 32 vessels had not returned to their launch sites. Appendix 2 presents the raw data collected at the three sites surveyed.

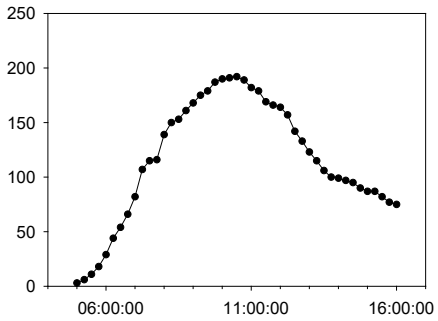

Figure 10 Total number of vessels estimated to be within or adjacent to JBMP at any given point in time, as inferred by vessel launches and landings at Green Head, Jurien Boat Harbour boat ramp and Cervantes Beach launch site on 11/04/04

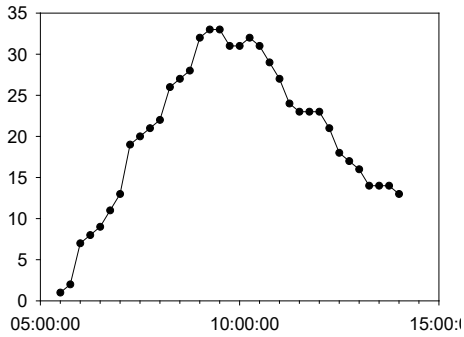

Figure 11 Number of vessels estimated to be within or adjacent to JBMP at any given point in time, as inferred by vessel launches and landings at Green Head boat ramp (north) on 11/04/04

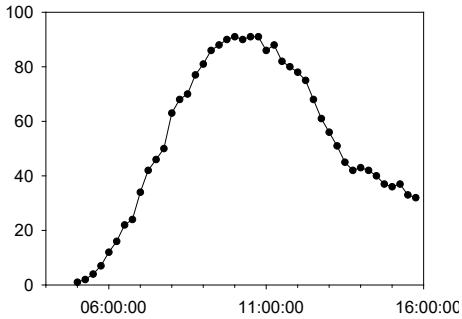

Figure 12 Number of vessels estimated to be within or adjacent to JBMP at any given point in time, as inferred by vessel launches and landings at Jurien Boat Harbour boat ramp on 11/04/04

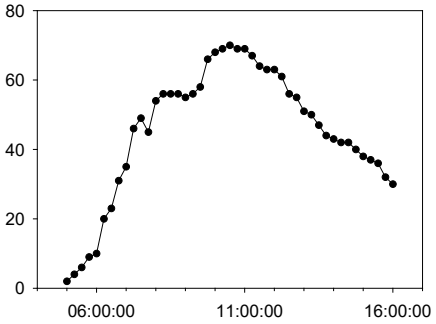

Figure 13 Number of vessels estimated to be within or adjacent to JBMP at any given point in time, as inferred by vessel launches and landings at the Cervantes Beach boat launch site on 11/04/04

Vessel activities

At the Green Head boat ramp (north), 22 vessels containing 66 people (average of 3 persons per vessel) were surveyed (58% of the vessels launched). Approximately 55% of these vessels were engaged in recreational fishing; a further ~32% of vessels engaged in a range of extractive activities including fishing and/or taking rock lobster; and the remaining ~13% of vessels engaged in passive activities including commercial sea lion interactions at North Fisherman's Island.

At the Jurien Boat Harbour boat ramp, 77 vessels containing 242 people (average of 3 persons per vessel) were surveyed (62% of the vessels launched). Approximately 68% of these vessels were engaged in recreational fishing; a further ~27% engaged in a range of extractive activities (including fishing and/or taking rock lobster), and the remaining ~5% of vessels engaged in passive activities (including sight seeing, SCUBA, swimming and water skiing.

At the Cervantes beach launch site, 48 vessels containing 123 people (average of 3 persons per vessel) were surveyed (52% of the vessels launched). Approximately 58% of these vessels were engaged in recreational fishing, a further ~40% of vessels engaged in a range of extractive/passive activities including fishing, taking rock lobster; swimming, snorkelling and surfing; and the remaining ~2% of vessels engaged in entirely passive activities such as visiting islands.

3.2.2 All day observation survey data ground truthed by aerial survey data

An aerial survey was conducted during part of the all day observation surveys conducted at three of the major boat launch sites during Easter 2004. The aerial survey recorded a total of 225 vessels in and adjacent to the park (i.e. to the west) and recorded 31 trailers at Green Head boat launch (south) and 26 trailers at Wedge Island boat launch beach which were surveyed as part of the all day observation surveys. During the aerial survey period (i.e. from 9 am to 11 am) the all day observation surveys recorded 192 vessels as being launched. Therefore a total of 249 vessels had been launched from boat launch sites throughout the park.

Therefore by not surveying the two boat ramps, (Green Head – south and Wedge Island) the all day observation surveys did not account for 57 vessels or 23% of vessels recorded in the park. The aerial surveys did not record 24 vessels or 10% of the total number of vessels, which may be the result of not observing vessels located to south or north of the park.

3.3 VISITOR QUESTIONNAIRE

A visitor questionnaire was administered at high usage sites (including camp sites, day use and local Easter festivals) during the Easter long weekend, using the method described in *Human Usage Monitoring Program (HUMP): Jurien Bay Marine Park Aerial Survey, Observational Surveys and Visitor Questionnaire (Easter 9-12 April 2004)* (Grubba *et. al*., 2004). The data collected can be used to assess 1) visitor awareness and knowledge of the JBMP, park zoning, key ecological values and pressures; and 2) types and temporal and spatial patterns of human usage.

3.3.1 Results

A total of 131 questionnaires were administered during the four day survey period between Green Head and Grey. Six distinct visitor groups (Table 8) were sampled during the survey with varying degrees of effort.

Table 8 Breakdown of survey effort

GROUP SURVEYED	SPECIFIC SITES	NUMBER & % OF RESPONSES
Day use visitors	Jurien Bay & Cervantes	45 (34.4%)
Campers	Sandland Is, North Head & Hill River	37 (28.2%)
Visitors to the Easter festivals	Jurien & Cervantes	23 (17.6%)
Day use visitors	Kangaroo Pt & Hangover Bay	17 (13%)
Shack communities	Grey	8 (6%)
Recreational boaters	Cervantes	1 (0.8%)

A summary of the responses to the questionnaire is presented in Table 9 and the raw data for each individual survey is presented in Appendix 3. In some cases respondents did not answer all the questions and therefore the percentage values presented in the table do not total to 100%. In addition a number of questions allowed for multiple responses and therefore percentages provided may exceed 100%.

The typical visitor to the area during Easter 2004 was older than 25 years (~76% of respondents) visiting the Jurien region for the first time (~30%) or visiting 2-5 times a year (~21%), typically with family (~87%) or friends (~38%) either camping (~47%), staying in a residential house (~28%) or caravan park (~15%) and engaging in one of the four top recreational activities which include beach fishing (~60%), swimming (~39%), boat fishing (~28%) or walking (~26%).

While recreational boat fishing is ranked third most popular activity in the region, only 0.8% of the sample comprised recreational boaters. It is likely that recreational boat fishing is a major activity in the park when all types of visitors to the region are randomly surveyed.

Approximately 60% of visitors surveyed were aware of the JBMP, while only 20% were aware of the park boundaries and ~56% were aware of the park zoning scheme. Visitors gained this level of awareness from brochures (~17%) and general knowledge (~13%). In relation to park values, such as marine wildlife, fish and seagrass, those surveyed had a good understanding of values, the importance of protecting values and the pressures impacting on values.

Table 9 Summary of responses to questions asked in the questionnaire

PARK BOUNDARIES AND ZONING

	Number of responses	% of responses
Aware of the Park		
Yes	78	59.5%
No	52	39.7%
Aware of the north and south Park boundaries		
Yes – North	18	23.1%
No – North	57	73.1%
Yes – South	15	19.2%
No – South	60	76.9%
How did you hear about the Marine Park?	0	0.0%
Word of mouth/friend	15	19.2%
TV/Radio	8	10.3%
Newspaper	11	14.1%
Tourist bureau	1	1.3%
Local knowledge	13	16.7%
Don't recall	1	1.3%
Map/poster	4	5.1%
Signs (on land)	3	3.8%
Yellow zone marker (marine)	0	0.0%
Brochure	13	16.7%
General knowledge	7	9.0%
Info Brochure for Shack owners	1	1.3%
Others	13	16.7%
Aware of Park zoning scheme		
Yes	44	56.4%
No	31	39.7%
Able to name a specific zone category		
No	41	52.6%
Yes	9	11.5%
Objectives of sanctuary zones		
None/no purpose	2	2.6%
Biodiversity and conservation	9	11.5%
Protect species or habitats	30	38.5%
Refuge area	9	11.5%
Research/baseline data	3	3.8%
Nature appreciation sites	1	1.3%
An area protected for future generations	0	0.0%
Replenishment areas	4	5.1%
Exclude fishing	3	3.8%
Don't know	3	3.8%
Other	11	14.1%
Able to name and identify the location of sanctuary zone		
Yes	17	21.8%
No	39	50.0%
How did you learn about the zones		
Word of mouth/friends	1	1.3%
TV/radio	3	3.8%
Newspaper	3	3.8%
Tourist bureau	0	0.0%
Local knowledge	5	6.4%
Don't recall	5	6.4%
Map/poster	7	9.0%
Signs (on land)	1	1.3%
Yellow zone marker (marine)	0	0.0%
Brochure	13	16.7%

	Number of responses	% of responses
General knowledge	10	12.8%
Info Brochure for Shack owners	1	1.3%
Other	8	10.3%

MARINE WILDLIFE

	Number of responses	% of responses
The nearshore islands of the Park are important areas for the ASL		
Strongly Agree	63	48.1%
Agree	57	43.5%
Neutral	6	4.6%
Disagree	1	0.8%
Strongly Disagree	0	0.0%
The nearshore islands of the Park are important areas for seabirds		
Strongly Agree	60	45.8%
Agree	59	45.0%
Neutral	5	3.8%
Disagree	3	2.3%
Strongly Disagree	0	0.0%
What do Australian Sea Lions use the islands for?		
Breeding	100	76.3%
Haul out	22	16.8%
Other	20	15.3%
Don't know	12	9.2%
What do seabirds use the islands for?		
Nesting	71	54.2%
Roosting	38	29.0%
Other	26	19.8%
Don't know	10	7.6%
Australian Sea Lions are important Park value		
Strongly Agree	68	51.9%
Agree	49	37.4%
Neutral	6	4.6%
Disagree	3	2.3%
Strongly Disagree	0	0.0%
Are you aware that the Australian sea lion is one of the rarest seal species in the world?		
Yes	34	26.0%
No	95	72.5%
Do you land on or anchor near any of the islands in the Park?		
Yes	25	19.1%
No	104	79.4%
How often?		
2-5 time a year	7	28.0%
First visit	5	20.0%
More than 5 times a year	3	12.0%
Once a year	3	12.0%
Less than once a year	2	8.0%
School holidays	2	8.0%
On a daily basis	1	4.0%
On a weekly basis	0	0.0%
Landing on and walking around islands might impact Australian Sea Lions		
Strongly Agree	26	19.8%
Agree	42	32.1%
Neutral	15	11.5%
Disagree	13	9.9%

	Number of responses	% of responses
Strongly Disagree	0	0.0%
Landing on and walking around islands might impact seabirds		
Strongly Agree	25	19.1%
Agree	41	31.3%
Neutral	13	9.9%
Disagree	14	10.7%
Strongly Disagree	0	0.0%
How did you learn about Australian Sea lions/seabirds in the Park?		
Other	30	22.9%
General Knowledge	24	18.3%
Didn't know	18	13.7%
Word of mouth/friends	6	4.6%
Brochure	6	4.6%
Jurien Bay Brochure	2	1.5%
Signage at boat ramps	1	0.8%
Internet	1	0.8%
Signage on islands	0	0.0%

FISH AND FISHING

	Number of responses	% of responses
Aware that fishing in the area is regulated by the Department of Fisheries using size and bag limits for different fish species		
Yes	117	89.3%
No	11	8.4%

SEAGRASS AND SEAWEED

	Number of responses	% of responses
Seagrass are an important component of the area		
Strongly Agree	66	50.4%
Agree	46	35.1%
Neutral	12	9.2%
Disagree	1	0.8%
Strongly Disagree	0	0.0%
The difference/s are between seagrass and seaweed		
Don’t know	80	61.1%
Other	25	19.1%
Seagrass soft bottom	13	9.9%
Seagrass green	9	6.9%
Algae hard bottom	6	4.6%
Seagrass has roots/rhizomes	5	3.8%
Algae red/brown/green	4	3.1%
Seagrass flowering plants	2	1.5%
Why is seagrass important?		
Food source	71	54.2%
Habitat	48	36.6%
Nursery areas	30	22.9%
Other	15	11.5%
Bind sediments	12	9.2%
Don’t know	11	8.4%
What type of human activities do you think might impact seagrasses in the Park?		
Other	63	48.1%
Boat anchors	36	27.5%
Dredging	16	12.2%
Divers	14	10.7%
Boat moorings	8	6.1%
Propellers	8	6.1%

	Number of responses	% of responses
Development	9	6.9%
Don't know	7	5.3%
Nutrient	6	4.6%
Terrestrial runoff	5	3.8%
Professional rock lobster fishers	4	3.1%

USAGE AND RESPONDENT INFORMATION

	Number of responses	% of responses
How often do you visit the Marine Park?		
First visit	39	29.8%
2-5 time a year	27	20.6%
Less than once a year	18	13.7%
More than 5 times a year	16	12.2%
Once a year	12	9.2%
On a daily basis	9	6.9%
School holidays (which holidays)	5	3.8%
On a weekly basis	2	1.5%
Where do you live?		
WA Perth Metro region	92	70.2%
WA Country	17	13.0%
Live locally	12	9.2%
Overseas (which country)	5	3.8%
Interstate (which State)	3	2.3%
Who are you here with today		
Family	102	87.2%
Friend(s)	44	37.6%
Yourself	7	6.0%
Other	4	3.4%
A commercial tour	2	1.7%
A school group	1	0.9%
Accommodation		
Camping	55	47.0%
Private house	33	28.2%
Caravan Park	17	14.5%
Hotel/motel	7	6.0%
Rented house	5	4.3%
Shack	5	4.3%
Other	4	3.4%
Do not stay overnight	2	1.7%
Activities		
Beach fishing (line)	78	59.5%
Swimming	51	38.9%
Boat fishing (line)	37	28.2%
Walking/running	34	26.0%
Camping	21	16.0%
Boating	19	14.5%
Picnic/BBQ	15	11.5%
Snorkeling	12	9.2%
4WD	13	9.9%
Other	13	9.9%
Rock lobster fishing	8	6.1%
Sightseeing	7	5.3%
Diving	7	5.3%
Beach going	6	4.6%
Water sports (surfing, windsurfing, kayak)	6	4.6%
Reef walking	3	2.3%
Spear fishing	2	1.5%
Jetty fishing	2	1.5%
Wildlife viewing	2	1.5%

	Number of responses	% of responses
Walking on islands	2	1.5%
Would you mind telling me which age category you fall into?		
40-59	57	43.5%
25-39	42	32.1%
60 & over	17	13.0%
15-24	12	9.2%
under 15	3	2.3%
Respondents Sex.		
Male	95	72.5%
Female	41	31.3%

3.3.2 Recommendations

The Easter 2004 survey was the first survey of visitors between Green Head and Grey since the gazettal of the Jurien Bay Marine Park in 2003. The survey was also one of the first major social surveys conducted by MCB and was developed "in-house" based on other surveys conducted by or for the Department.

Following the completion of the Easter 2004 survey, a number of concerns regarding questionnaire design and structure were identified including the length of the questionnaire (i.e. too long), question repetition and the effectiveness of questions to meet information requirements. It was identified that the questionnaire should be reviewed and revised, as required, by a person/s with expertise in questionnaire design.

While the number of questionnaires completed during Easter 2004 likely captures a representative sample of the overall population of people in the Jurien Bay area. When the population is divided into categories based on respondent type (Table 8) it is likely that shack and recreational boat fishers were under represented in the sample of people surveyed. Future questionnaires need to be designed and implemented to ensure and adequate representation of all respondents (Table 8) and should include methods developed to determine the total number of people visiting the area.

4 DATA MANAGEMENT

4.1 REPORT

Hard copies of this report will be held at three locations:

1. Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St., Fremantle, Western Australia, 6160. Ph (08) 9336 0100 Fax (08) 9430 5408.
2. Woodvale Library, Science and Information Division, Department of Conservation and Land Management, Ocean Reef Rd, Woodvale, Western Australia, 6026. Ph (08) 9405 5100 Fax (08) 9306 1641.
3. Archived with CD ROM, Woodvale Library, Science and Information Division, Department of Conservation and Land Management, Ocean Reef Rd.,Woodvale, Western Australia, 6026. Ph (08) 9405 5100 Fax (08) 9306 1641.

The Marine Conservation Branch will hold digital copies of the report:

1. On CD-ROM [mms_8505] held onsite at the Marine Conservation Branch
2. On the MCB homepage located within the framework of the Department of Conservation and Land Management Intranet (i.e. CALMweb):
3. http://calmweb.calm.wa.gov.au/drb/ncd/mcb/rep_mms.htm#8505

4.2 DATA STORAGE – JURIEN BAY MARINE PARK MARINE INFORMATION SYSTEM

All survey data r in this report and all metadata has been entered in the Jurien Bay Marine Park Marine Information System.

The original data sheets are archived at the Marine Conservation Branch.

5 REFERENCES

ANZECC (1997). *Best Practice in Performance Reporting in Natural Resource Management*. Australian and New Zealand Environment and Conservation Council, Working Group on National Parks and Protected Areas Management- Benchmarking and Best Practice Program. Department of Natural Resources and Environment. Melbourne, Victoria.

CALM (1994). *A representative marine reserve system for Western Australia. Report of the Marine Parks and Reserves Selection Working Group*. Department of Conservation and Land Management, Perth.

CALM (2000). *Vistat 2000. Guidelines for the collection of visitor information data on CALM-managed lands and waters*. Department of Conservation and Land Management.

CALM (2000). *Indicative management plan for the proposed Jurien Bay Marine Park.* Department of Conservation and Land Management.

CALM (2005). *Jurien Bay Marine Park Management Plan (2004-2014)*. Department of Conservation and Land Management, Perth.

Grubba T, Butcher L and Fitzgerald K. (2004). *Human Usage Monitoring Program (HUMP): Standard Operations Procedures Manual: Jurien Bay Marine Park.* Report MMS -86/2005. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St., Fremantle, Western Australia, 6160). Unpublished report.

Grubba T.L (In preparation). *An ecological and social monitoring framework for the management and auditing of Western Australian Marine Conservation Reserves.* Report MMS/66/02. Marine Conservation Branch, Department of Conservation and Land Management. Fremantle, Western Australia. Unpublished report

Grubba T., Butcher L. and Fitzgerald K. (2005). *Manual of Standard Operations Procedures: Human Usage Monitoring Program Jurien Bay Marine Park*. Report MMS -86/2005. (Marine Conservation Branch, Department of Conservation and Land Management, 47 Henry St, Fremantle, Western Australia 6160). Unpublished report.

Larkum A.W.D and Hartog C den (1989). *Evolution and biogeography of seagrasses.* Pp 112-156 in Biology of Seagrasses: A Treatise on the Biology of Seagrasses with special reference to the Australian Region. (Ed. AWD Larkum, AJ McComb and SA Shepherd) Elsevier/North Holland, Amsterdam. 841pp.

Lloyd J.J., C.J Simpson, and T.L Grubba (In preparation). *A performance assessment framework for marine conservation reserves in Western Australia*. Report MPC/02/2004. Marine Conservation Branch, Department of Conservation and Land Management. Fremantle, Western Australia. Unpublished report.

MPRA (2002). *Audit Policy*. Marine Parks and Reserves Authority.

Pollock K. H, Jones C. M., and Brown T. L. (1994). *Angler survey methods and their applications in fisheries management*. American Fisheries Society Special Publication 25. Bethesda, Maryland, USA.

Simpson C.J, Colman J.G, and Hill A.K. (2002). *A strategic framework for marine research and monitoring in the Shark Bay World Heritage Property*. Marine Conservation Branch, Department of Conservation and Land Management. Fremantle, Western Australia. Unpublished report.

APPENDICES

Appendix 1 Aerial survey data

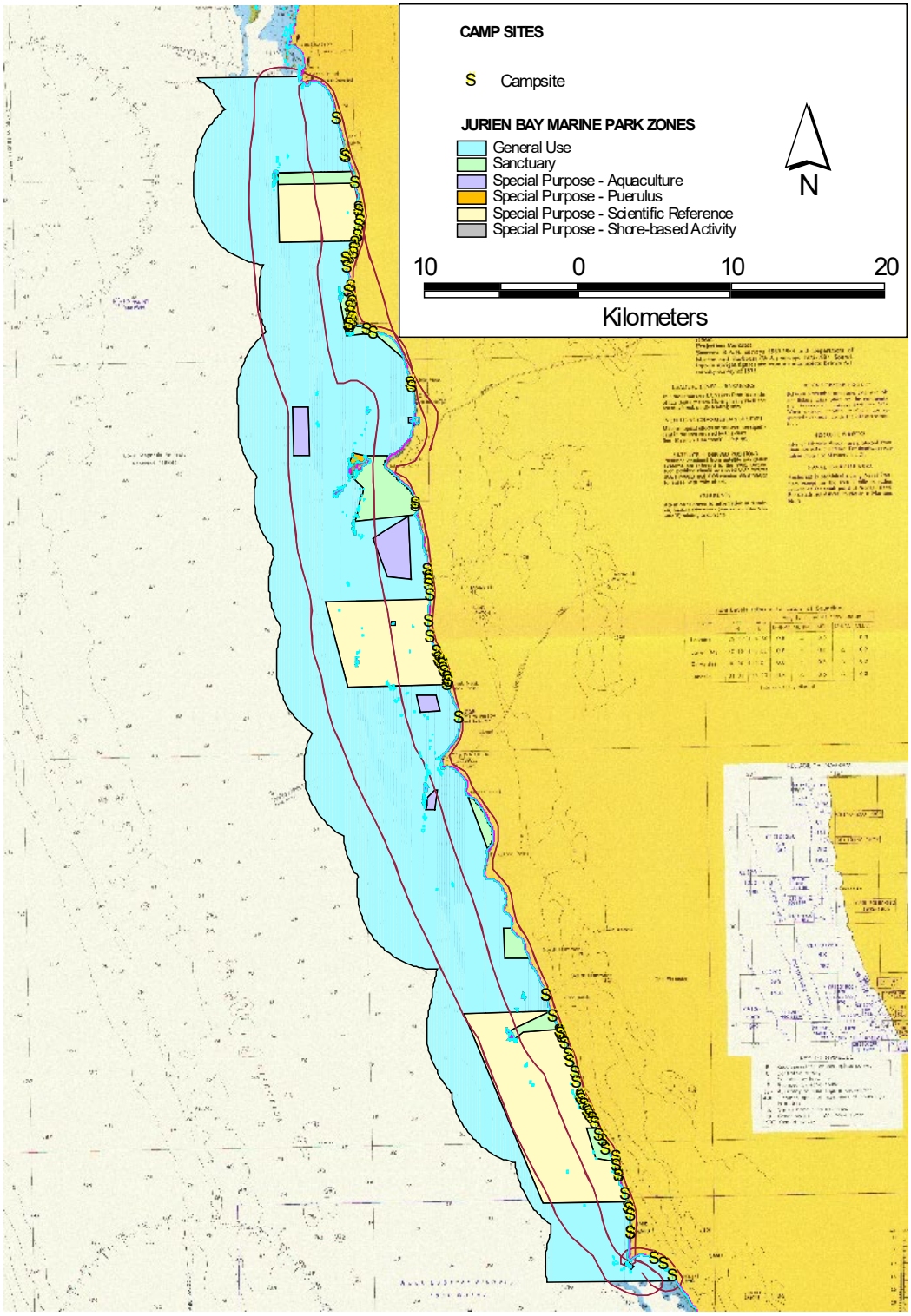

Figure 14 Distribution of campsites adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04

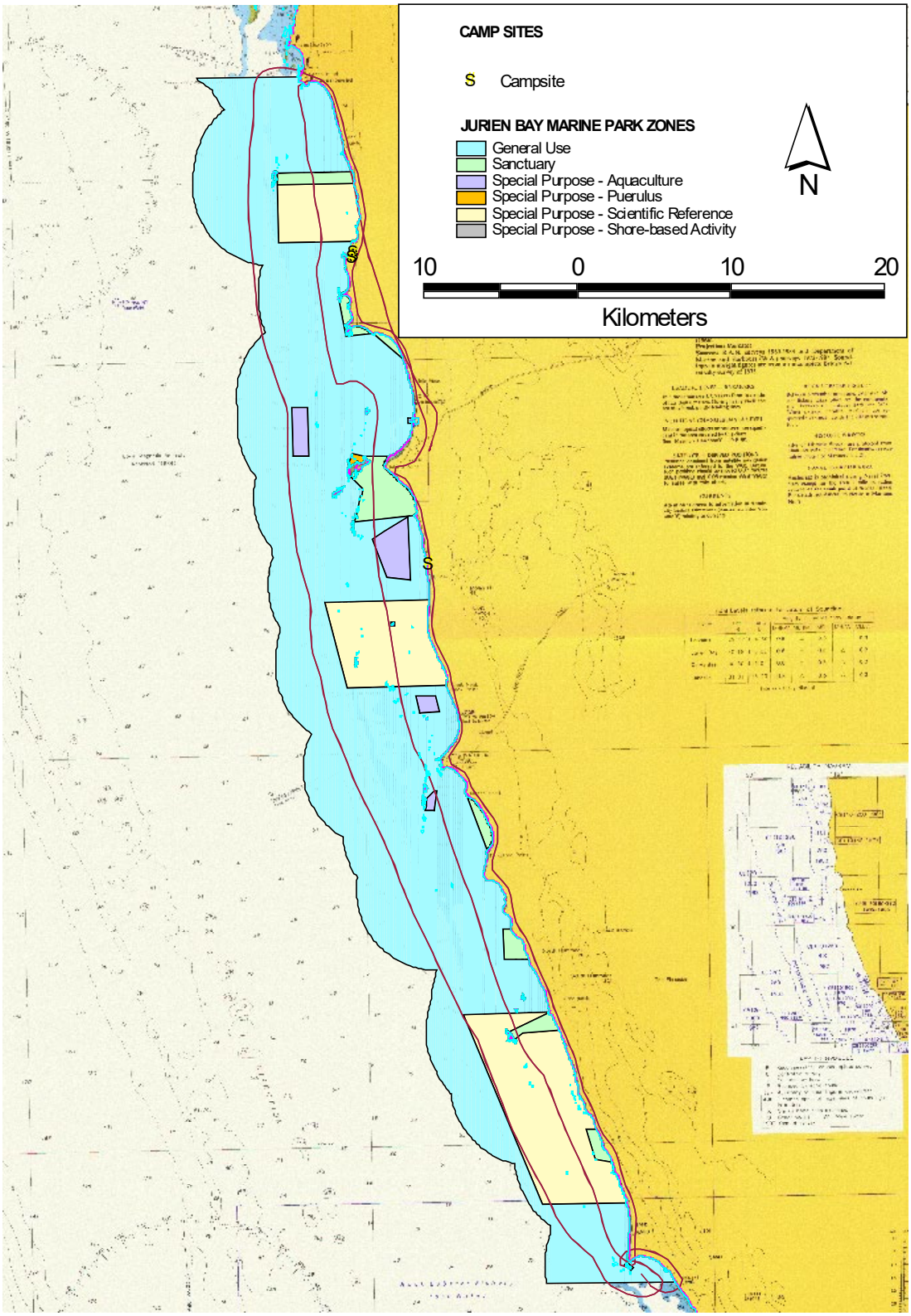

Figure 15 Distribution of campsites adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 19/06/04

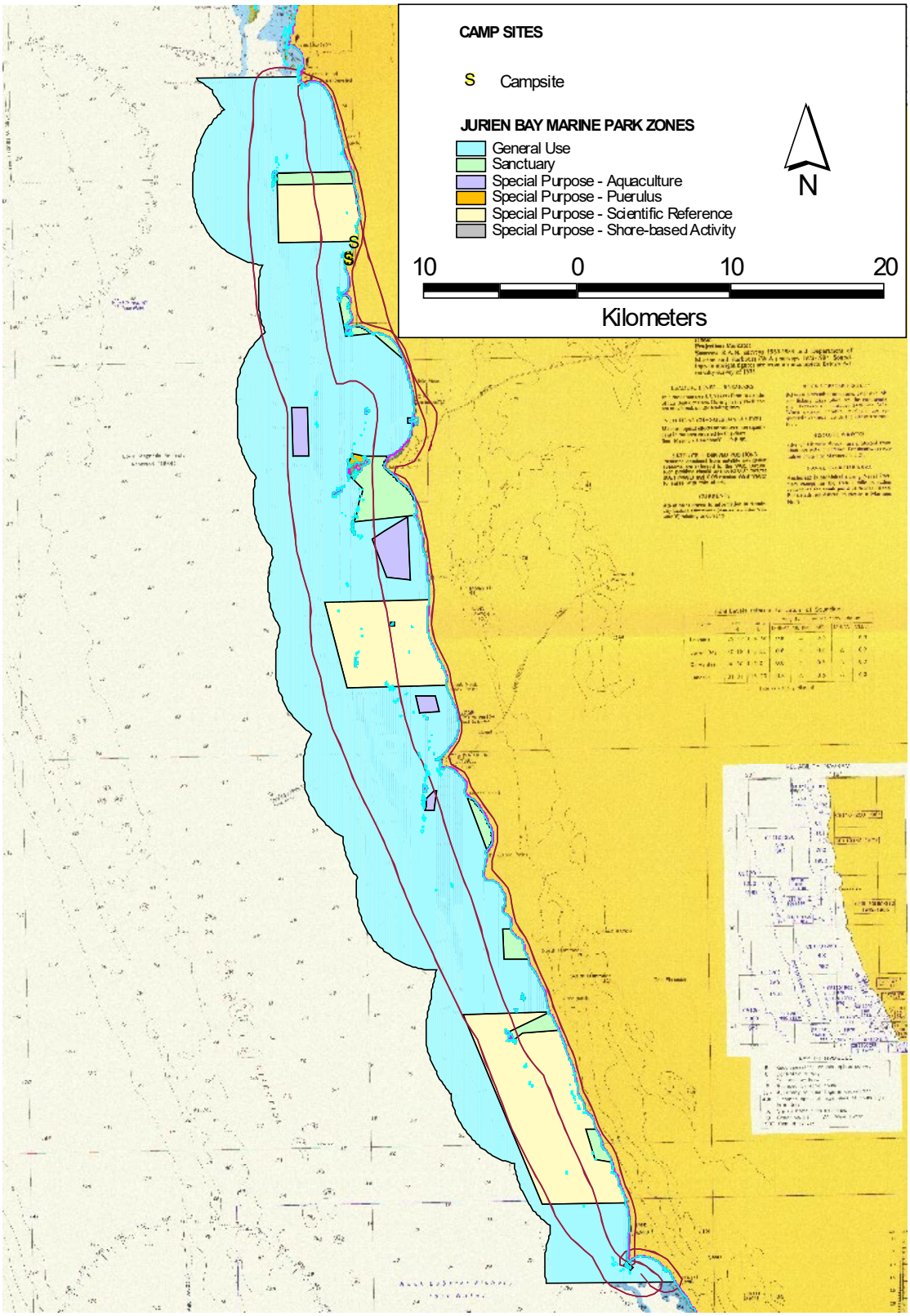

Figure 16 Distribution of campsites adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 24/07/04

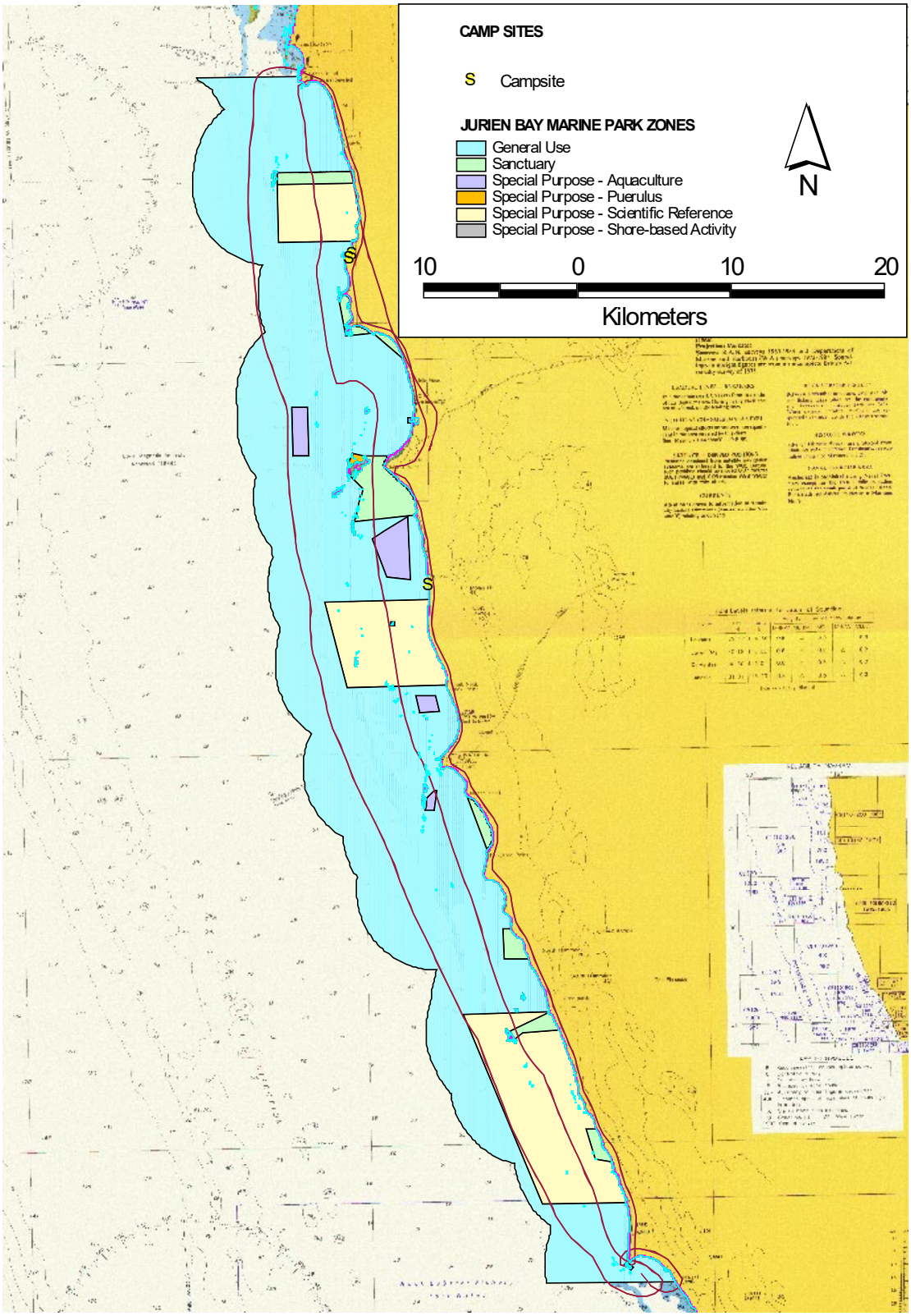

Figure 17 Distribution of campsites adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 04/09/04

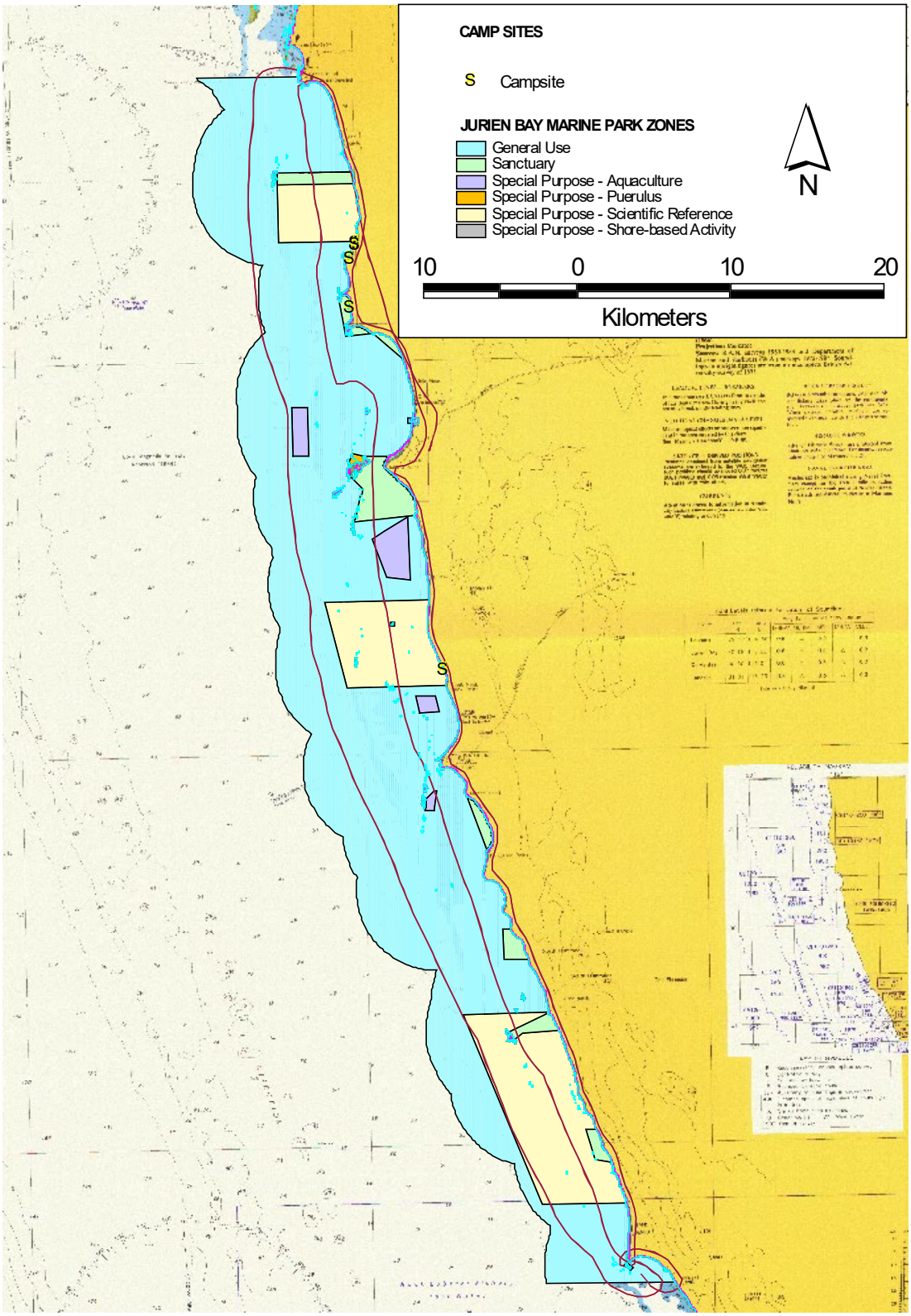

Figure 18 Distribution of campsites adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 09/10/04

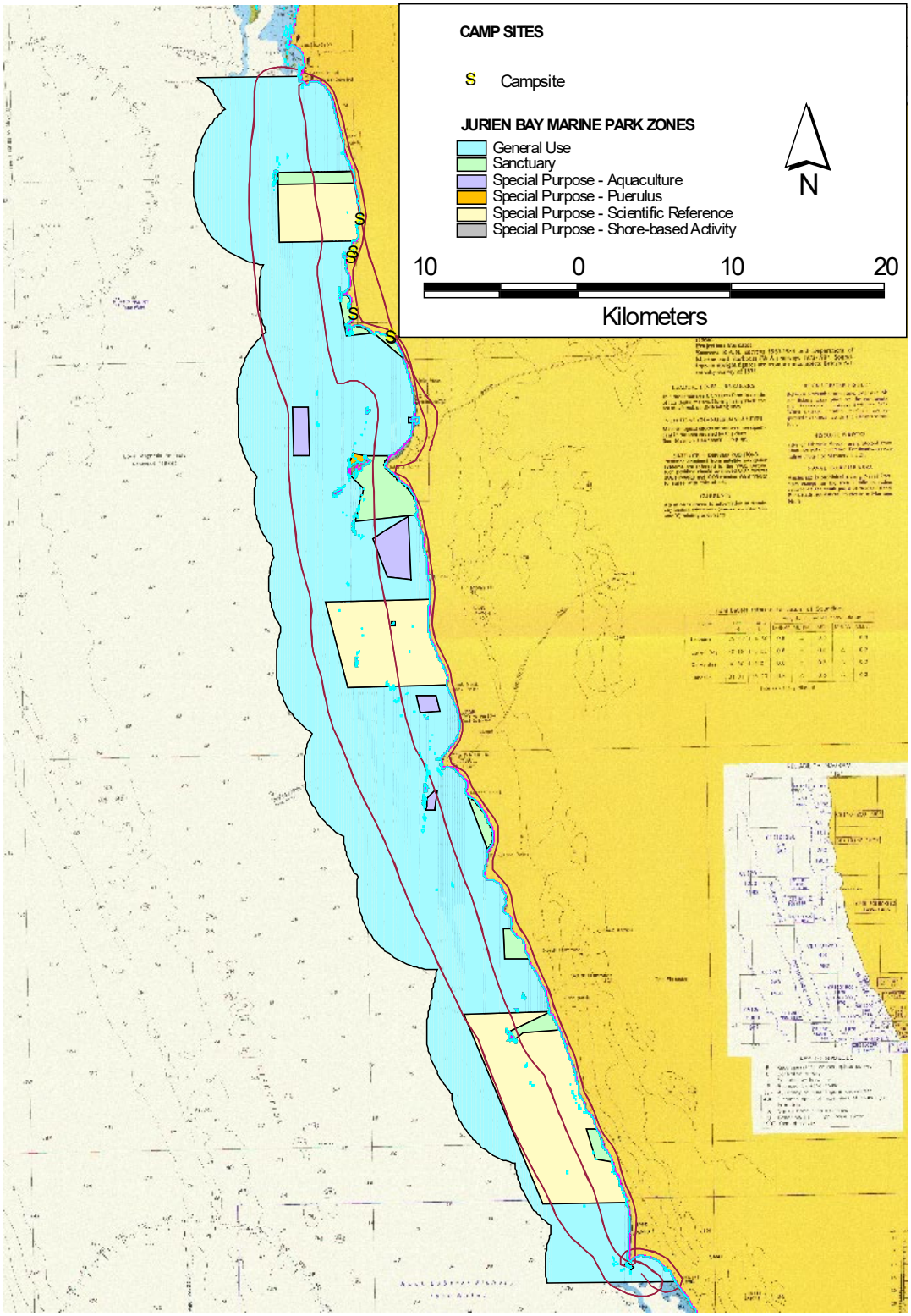

Figure 19 Distribution of campsites adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 20/11/04

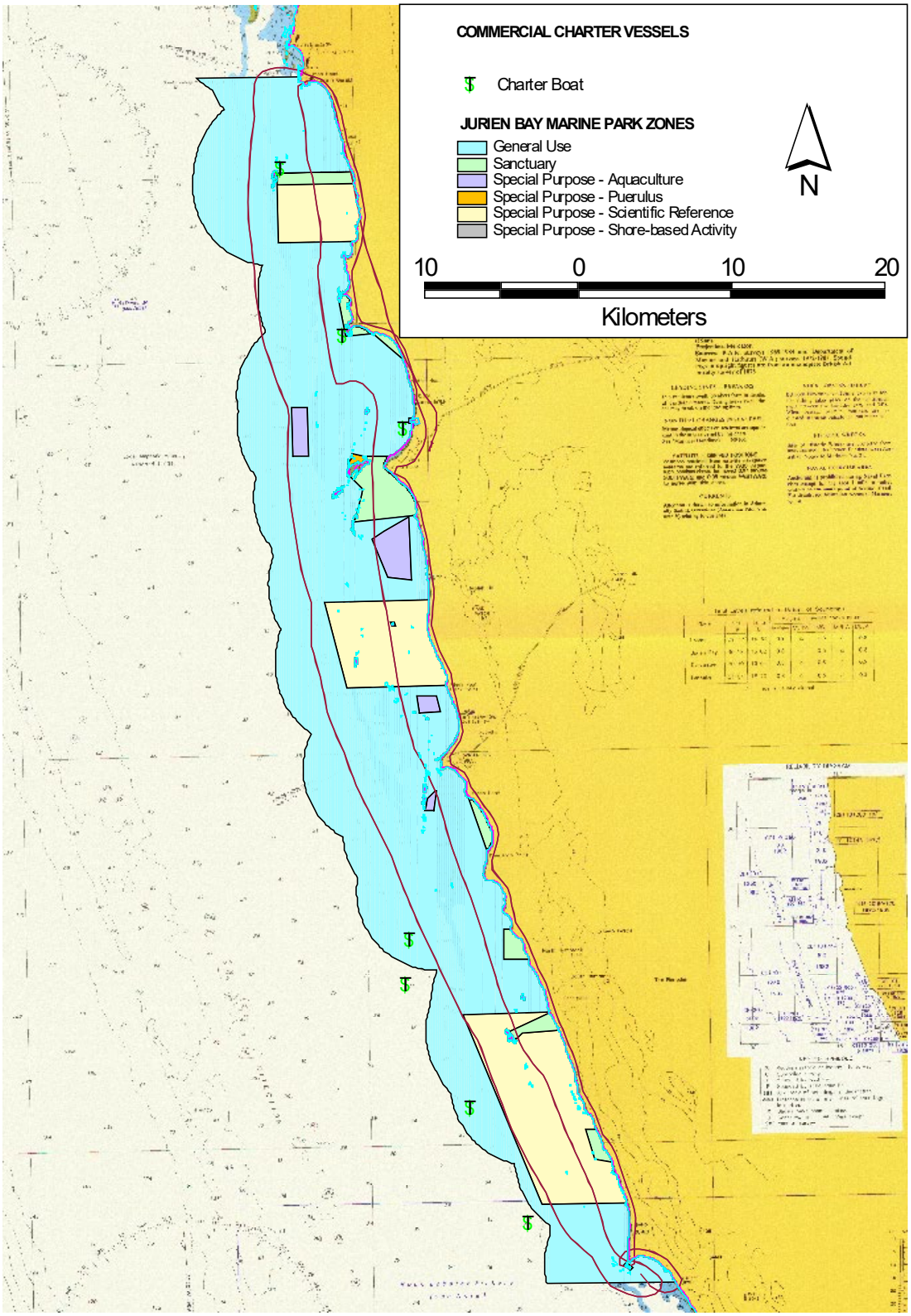

Figure 20 Distribution of commercial charter vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04

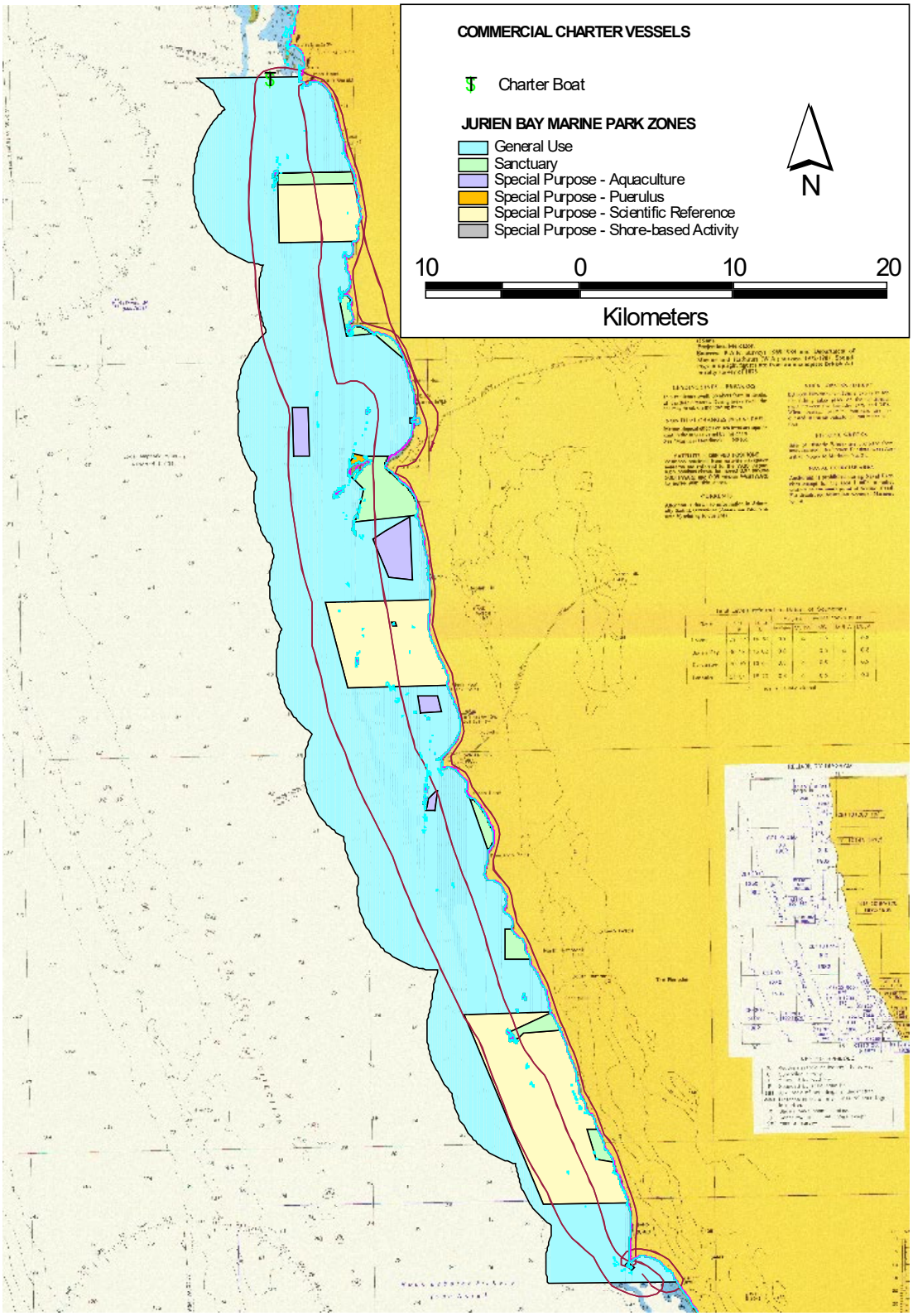

Figure 21 Distribution of commercial charter vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 24/07/04

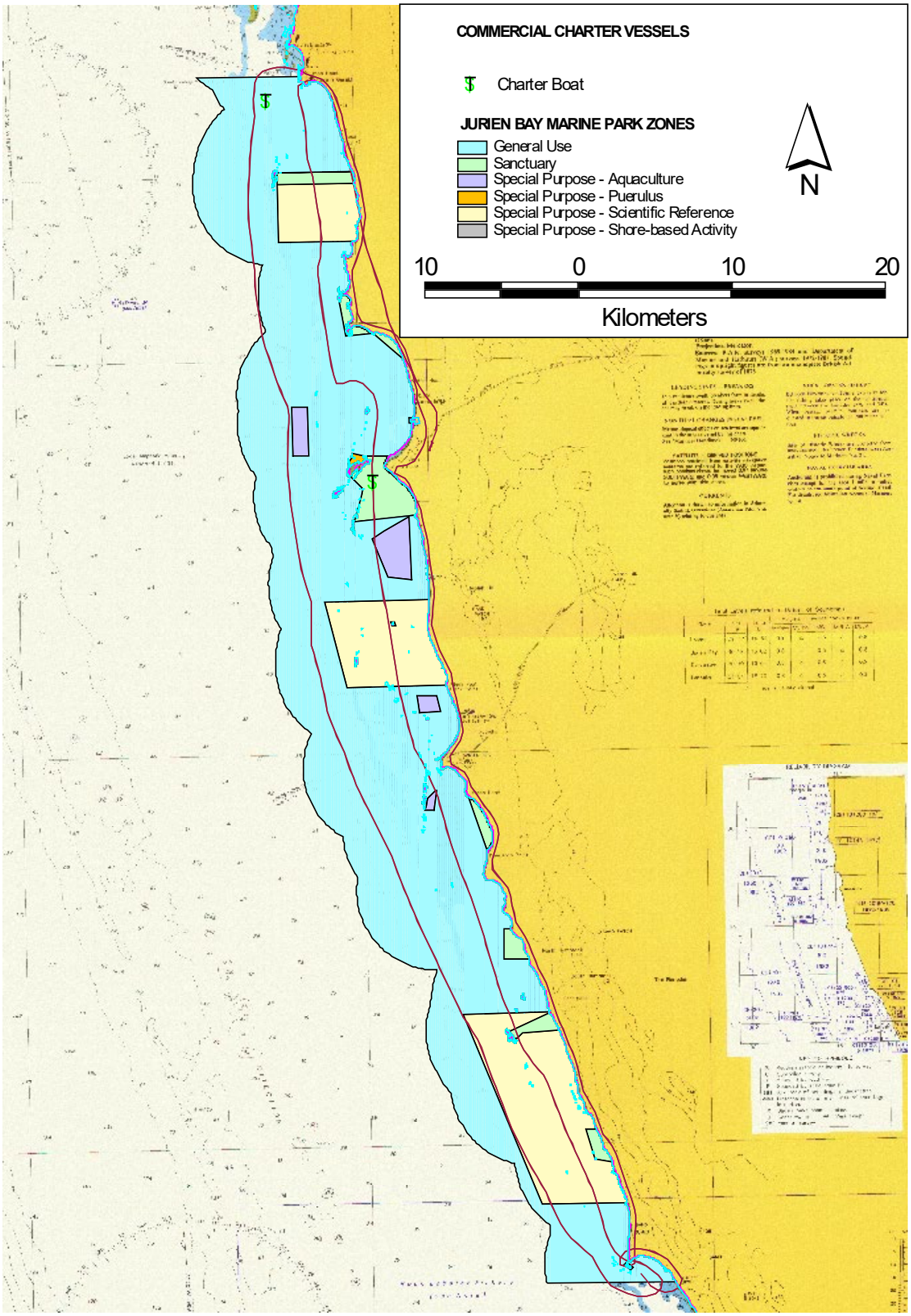

Figure 22 Distribution of commercial charter vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 04/09/04

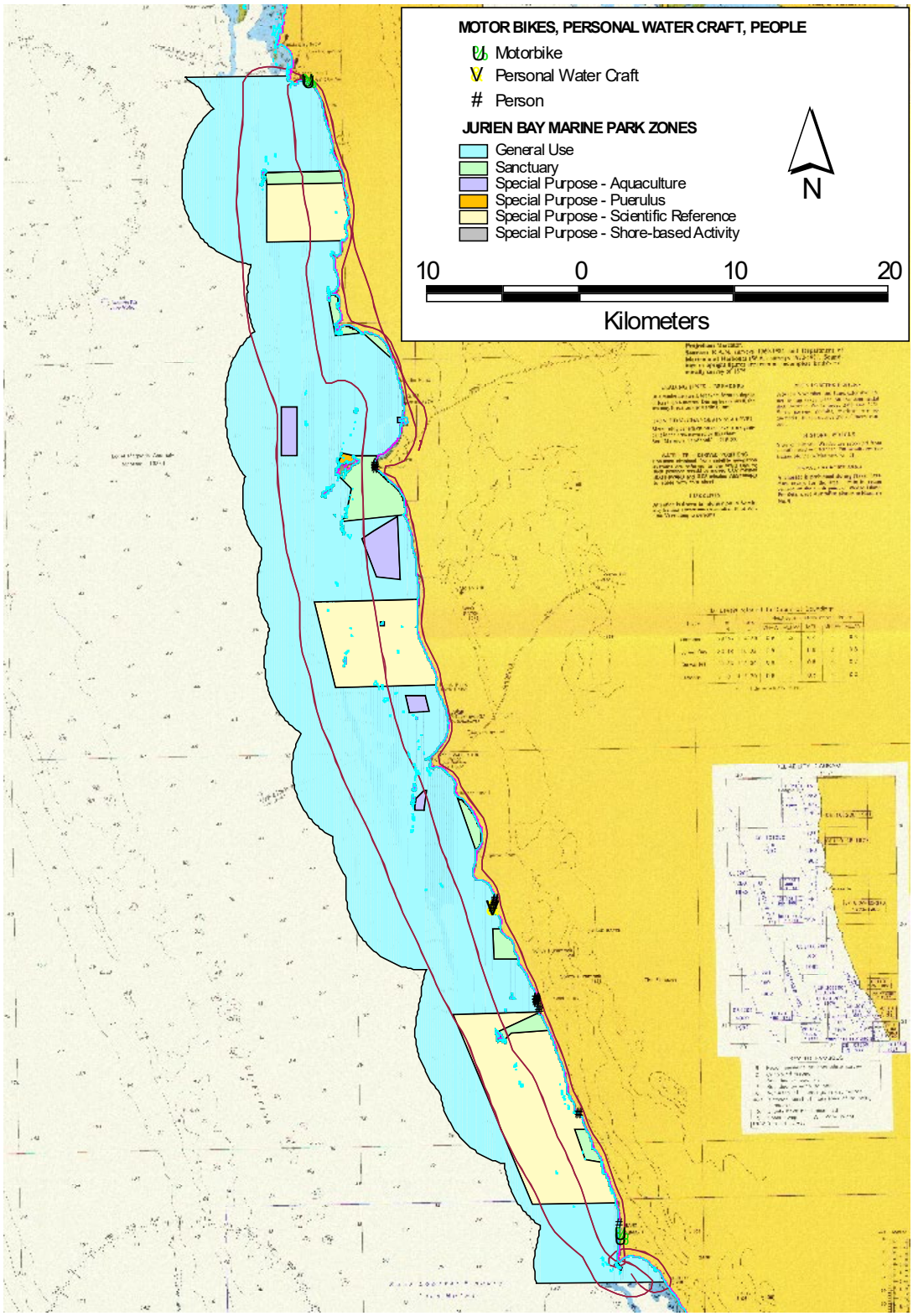

Figure 23 Distribution of motorbikes, people, and personal watercraft adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04

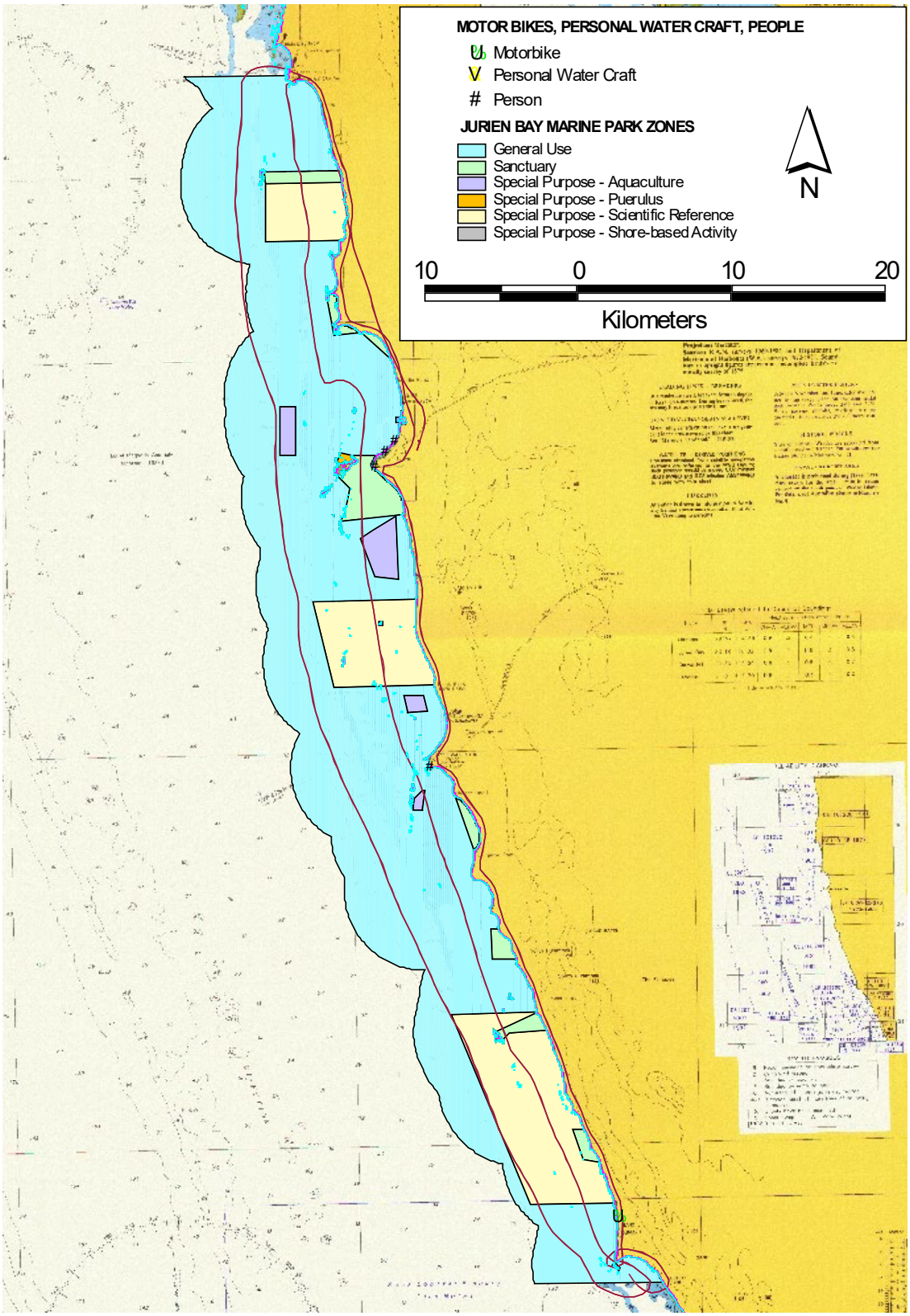

Figure 24 Distribution of motorbikes, people, and personal watercraft adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 19/06/04

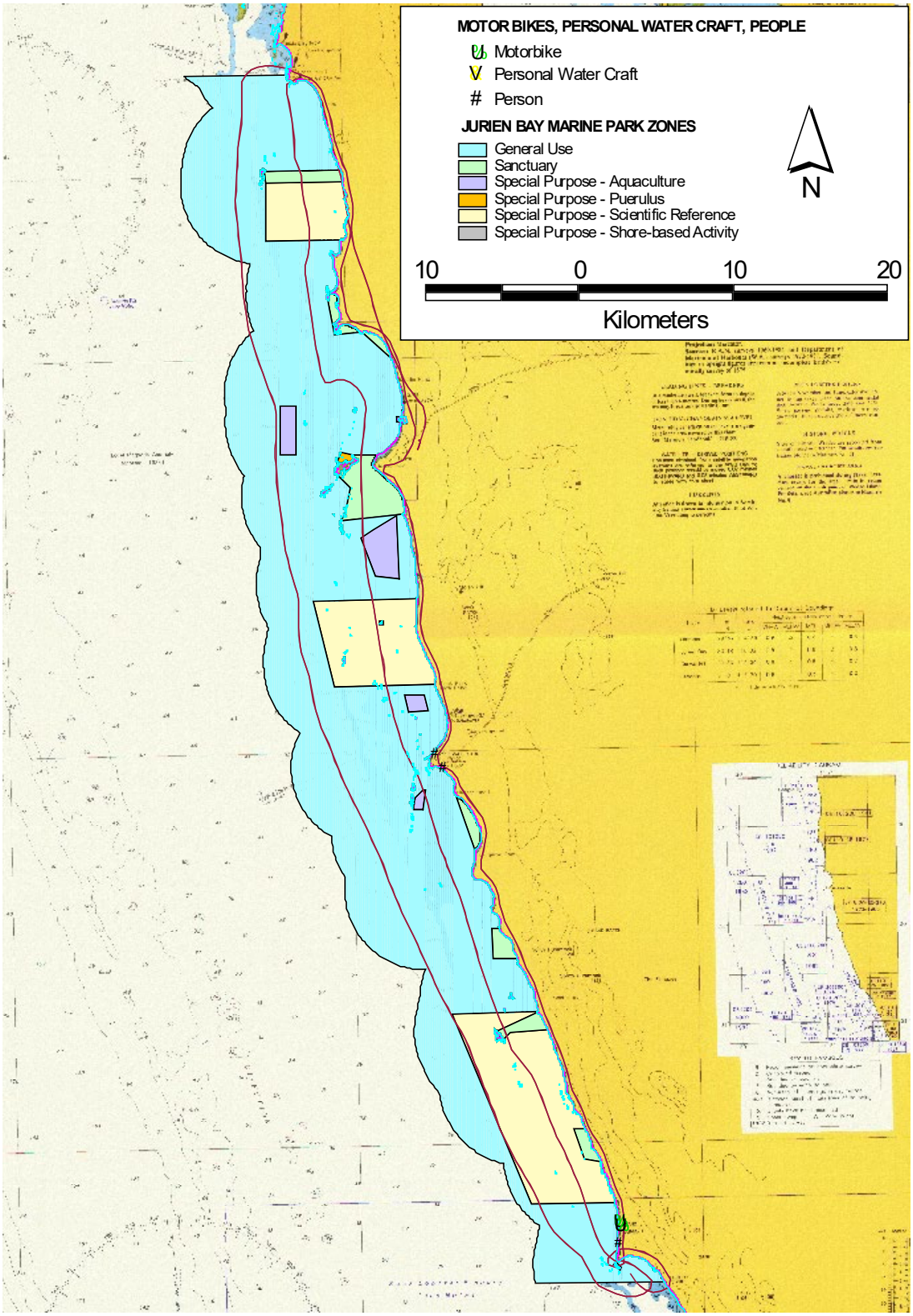

Figure 25 Distribution of motorbikes, people, and personal watercraft adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 24/07/04

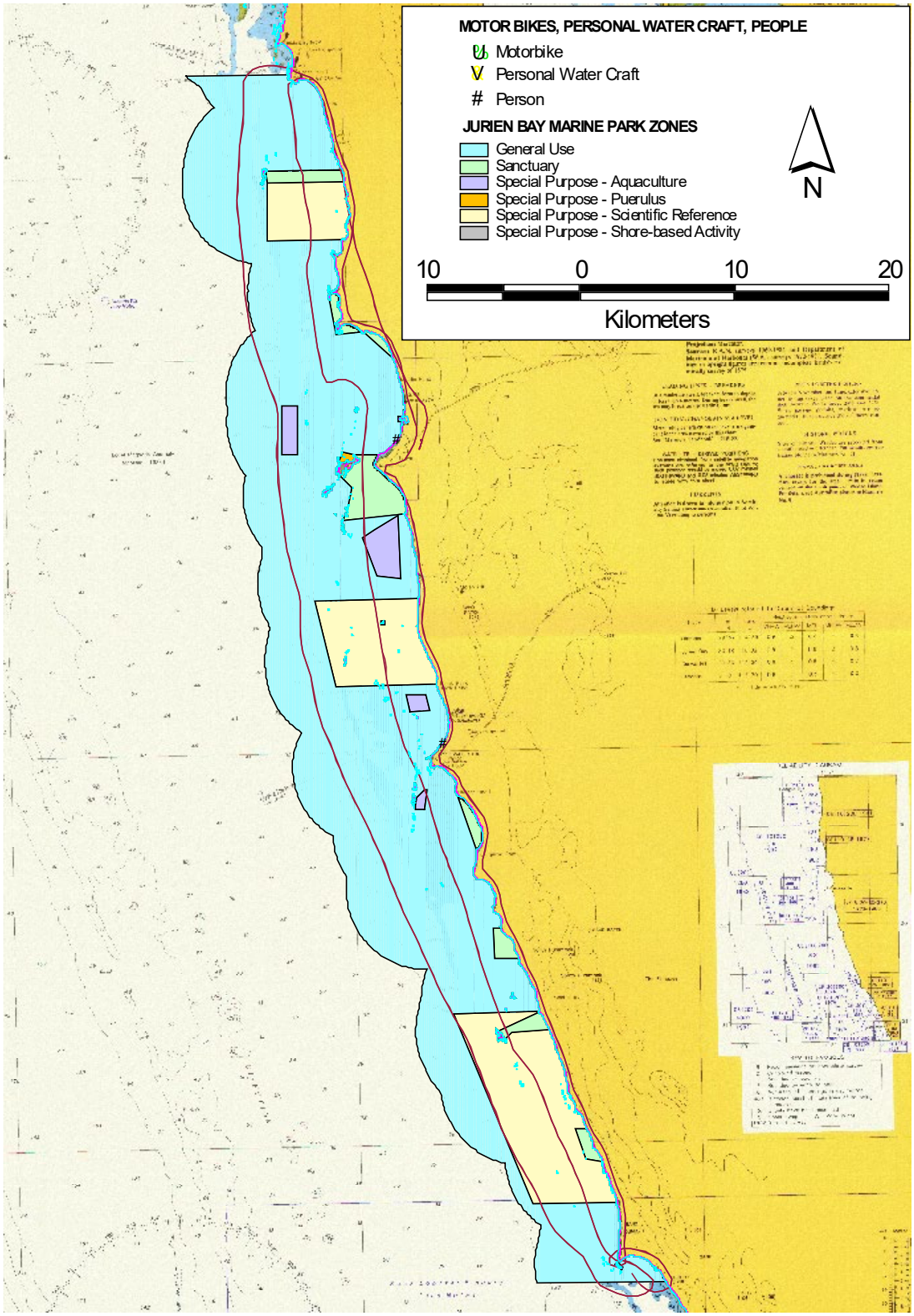

Figure 26 Distribution of motorbikes, people, and personal watercraft adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 04/09/04

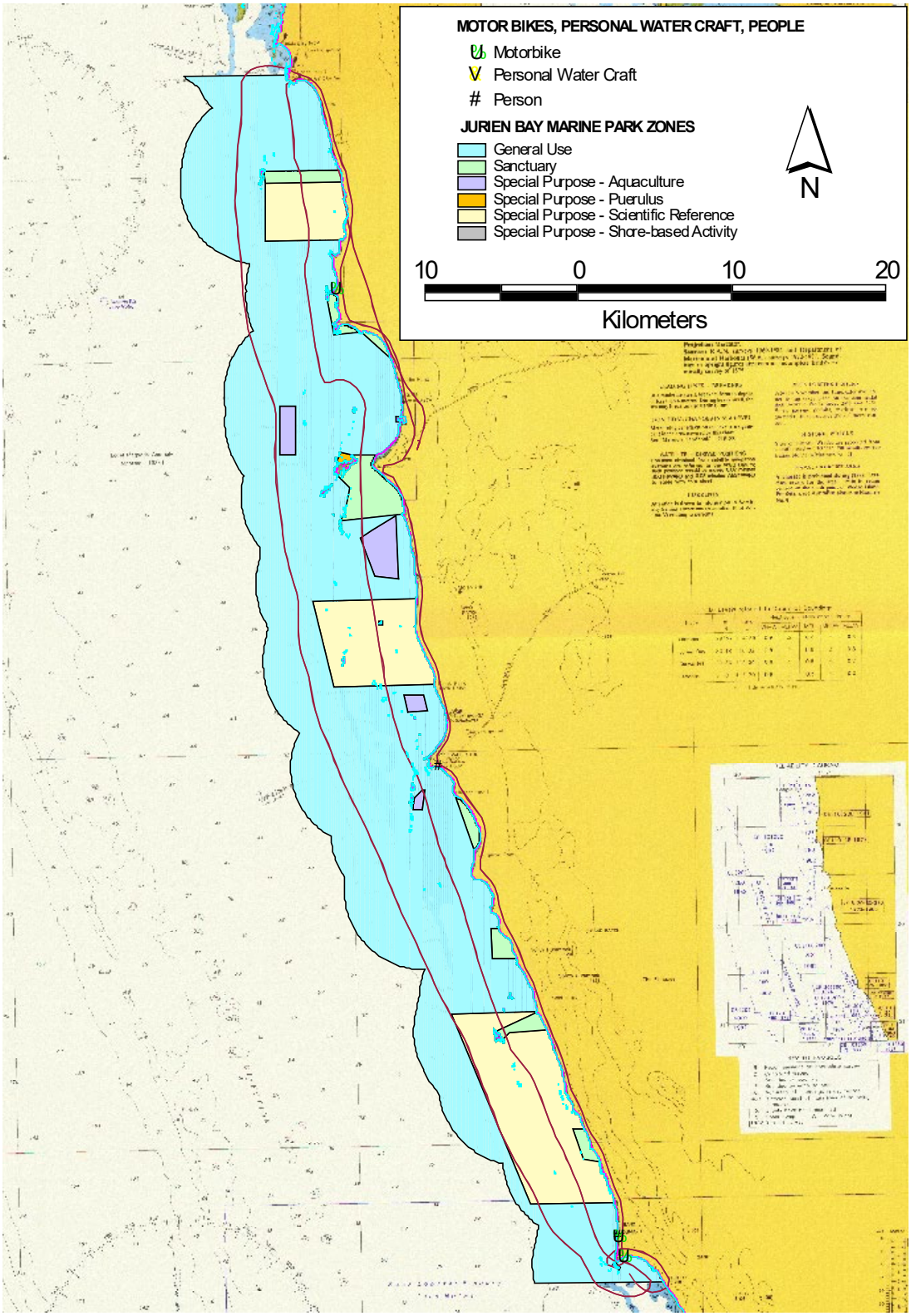

Figure 27 Distribution of motorbikes, people, and personal watercraft adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 09/10/04

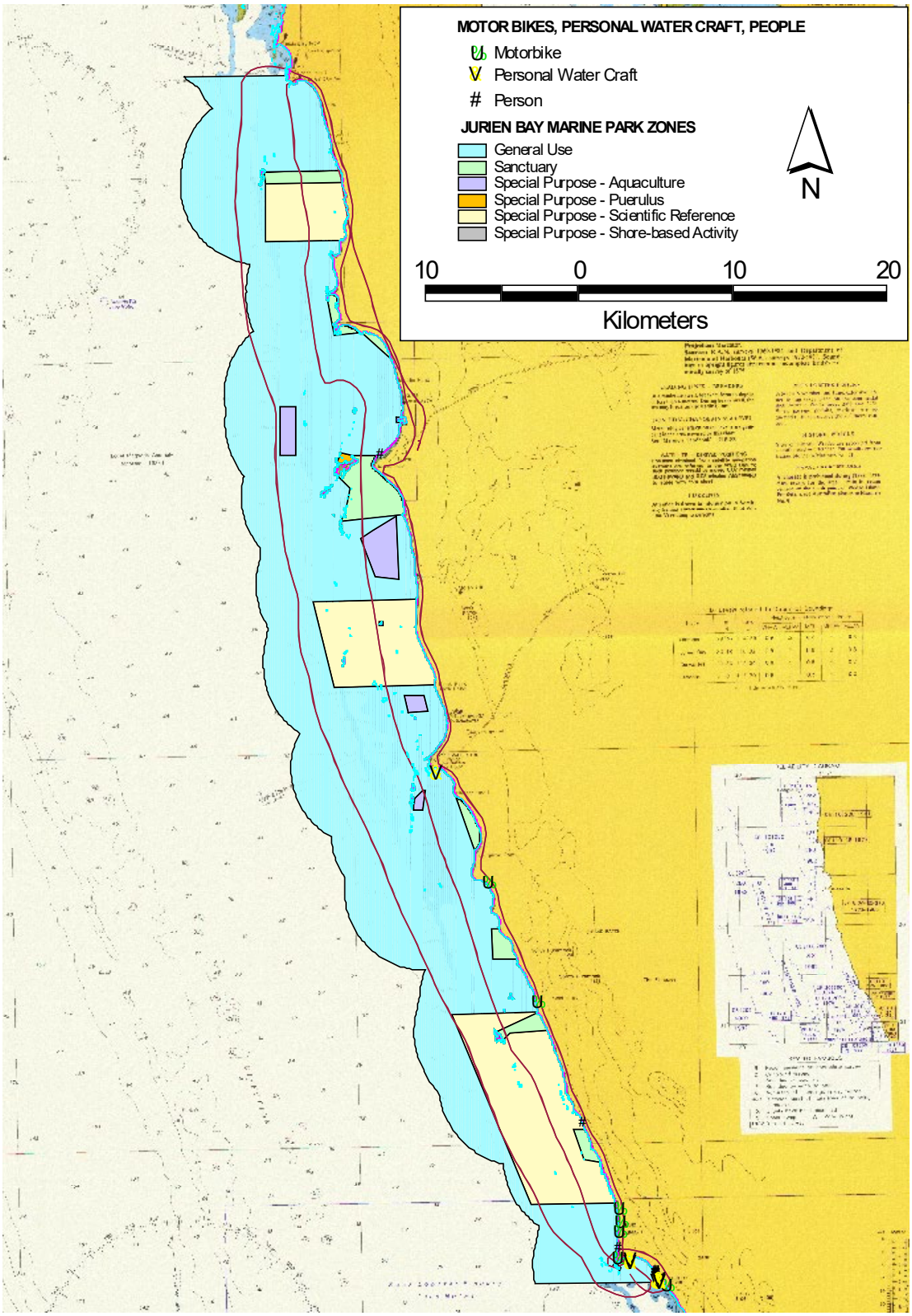

Figure 28 Distribution of motorbikes, people, and personal watercraft adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 20/11/04

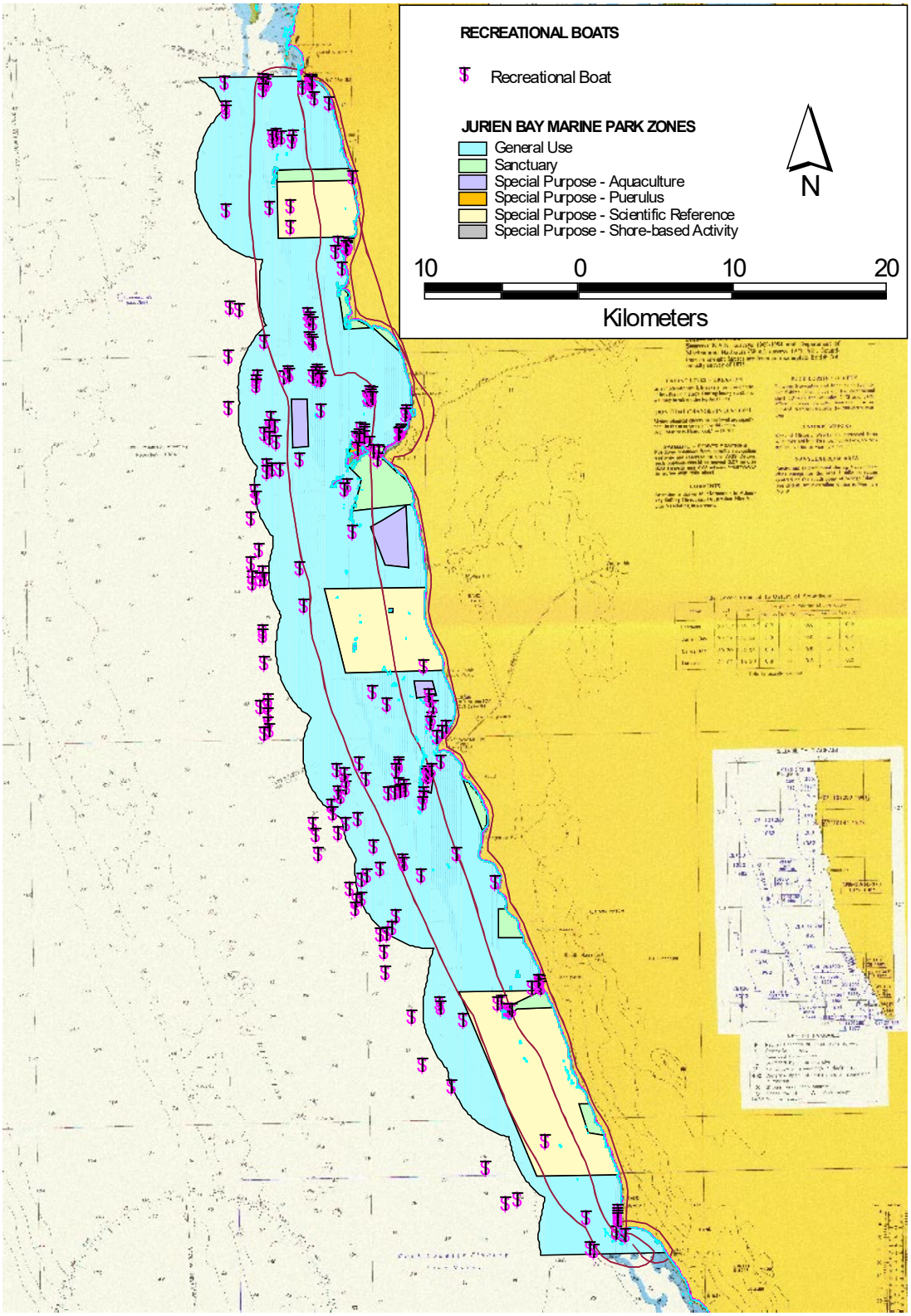

Figure 29 Distribution of recreational vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04

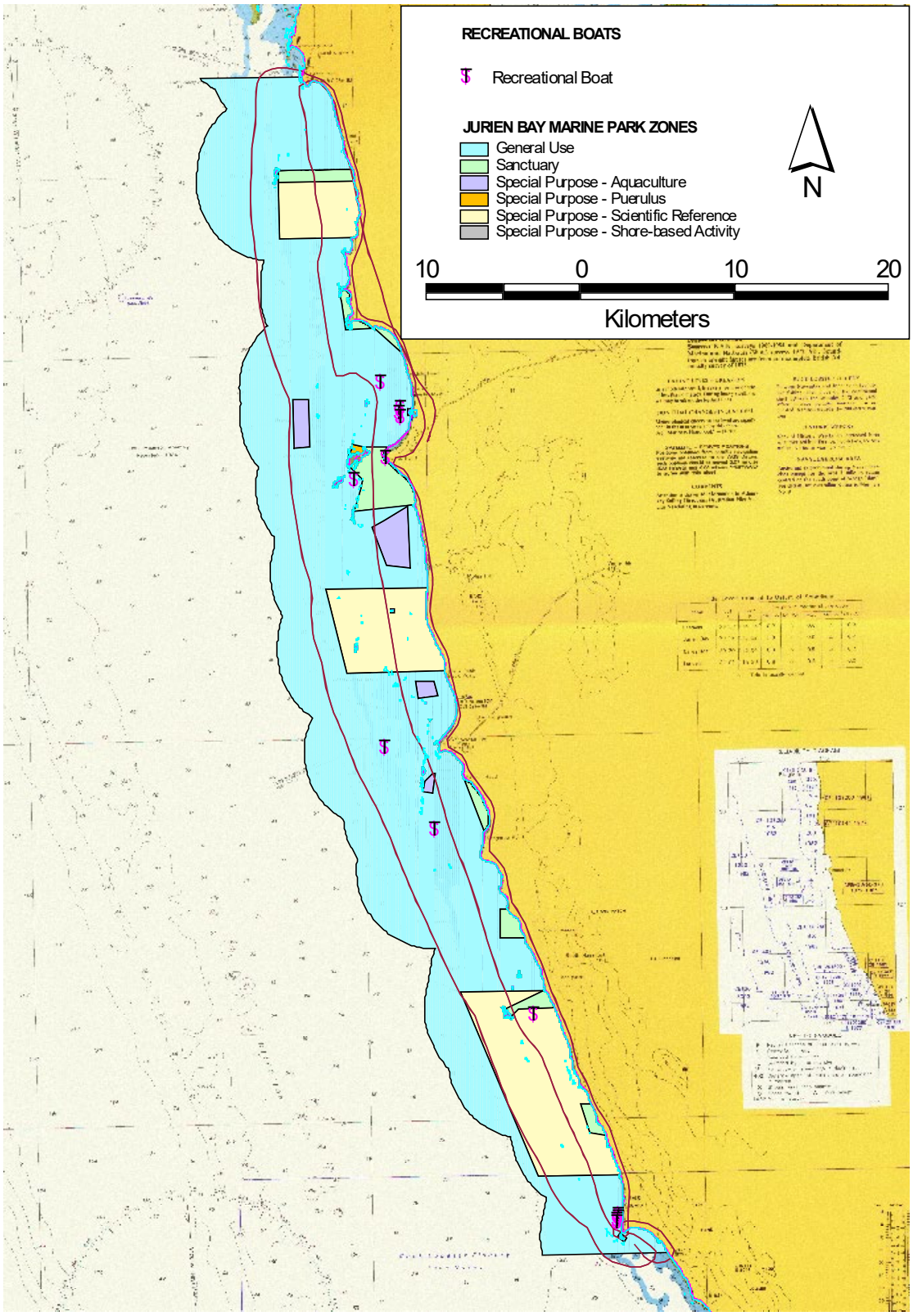

Figure 30 Distribution of recreational vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 19/06/04

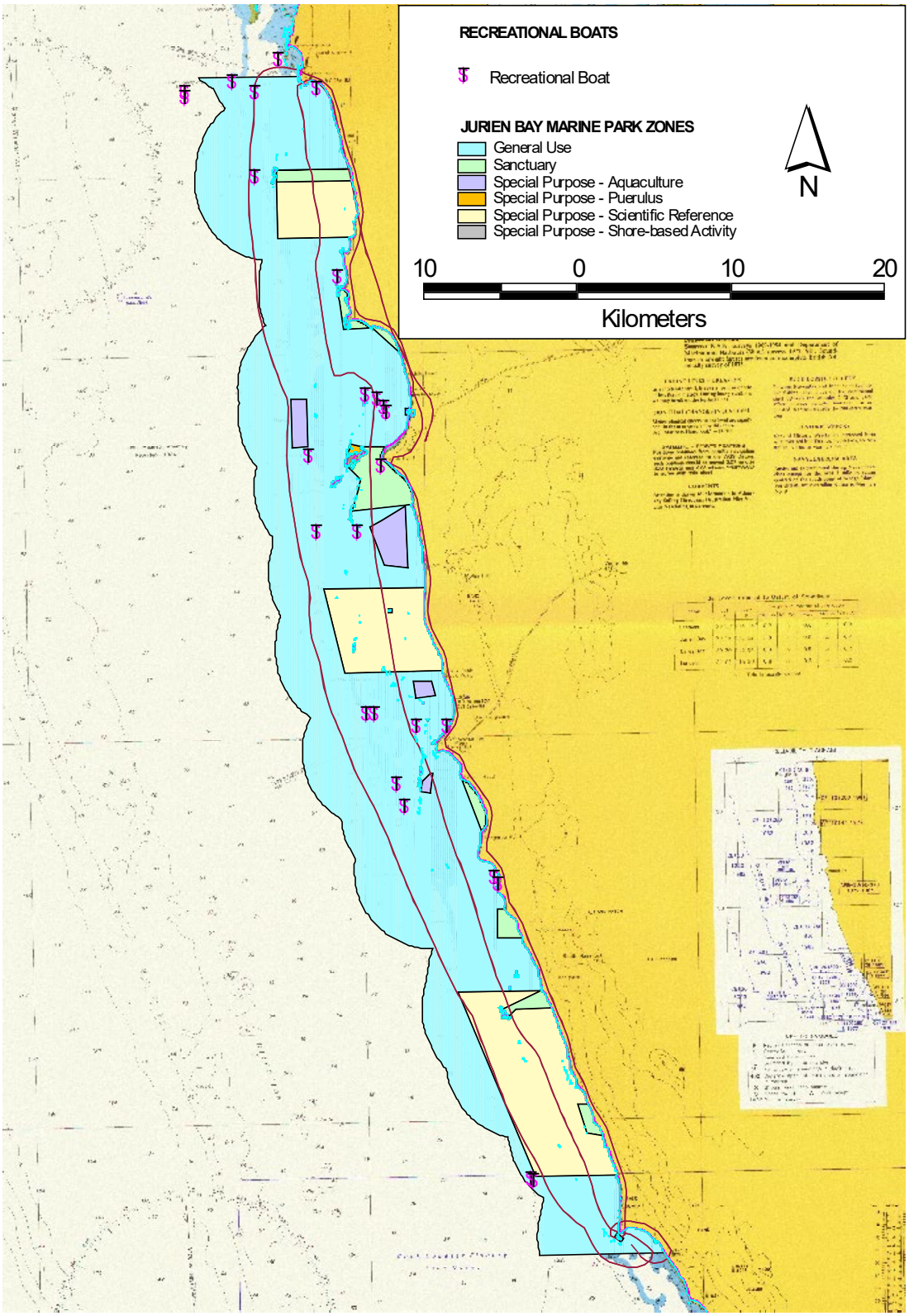

Figure 31 Distribution of recreational vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 24/07/04

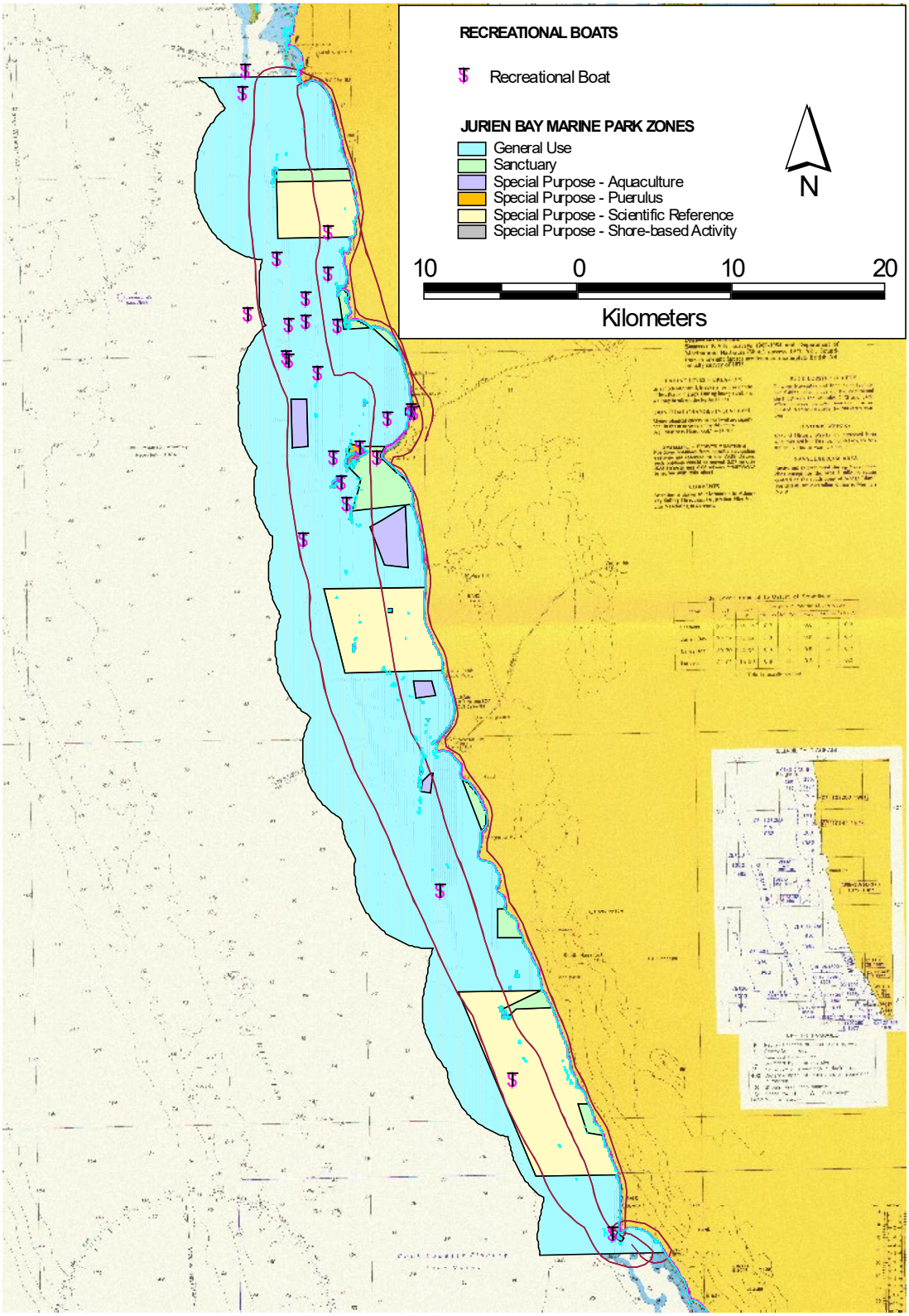

Figure 32 Distribution of recreational vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 04/09/04

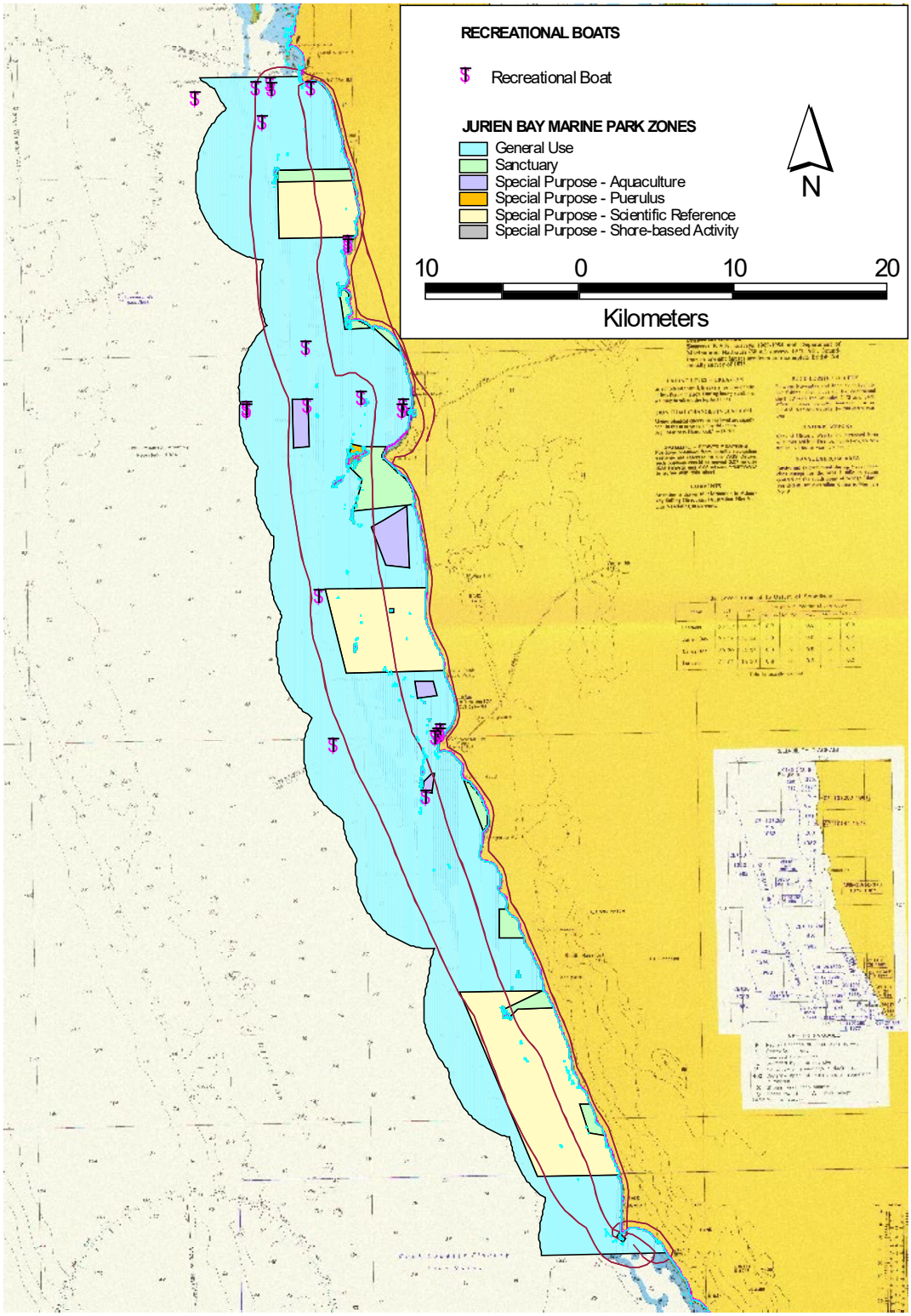

Figure 33 Distribution of recreational vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 09/10/04

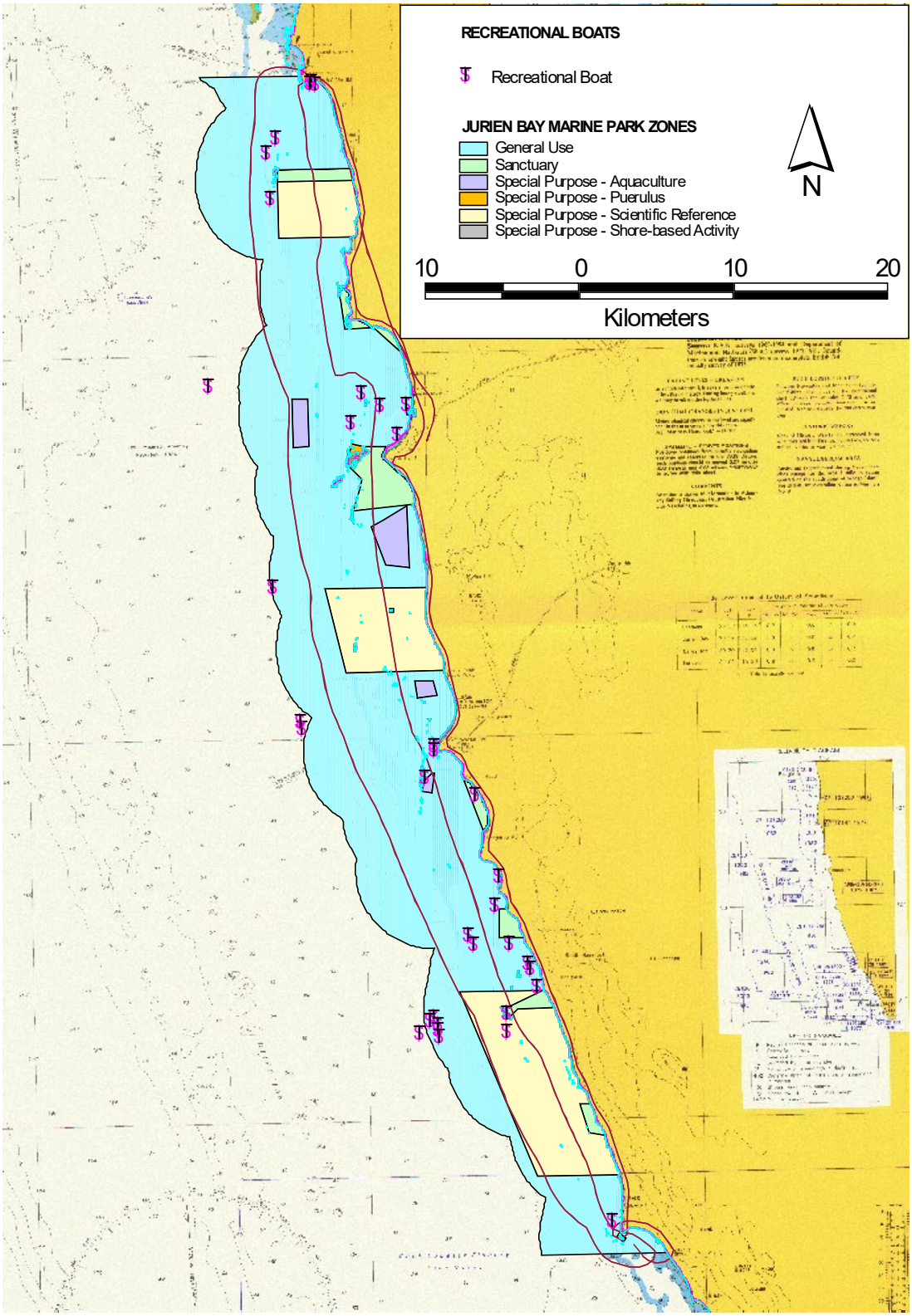

Figure 34 Distribution of recreational vessels adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 20/11/04

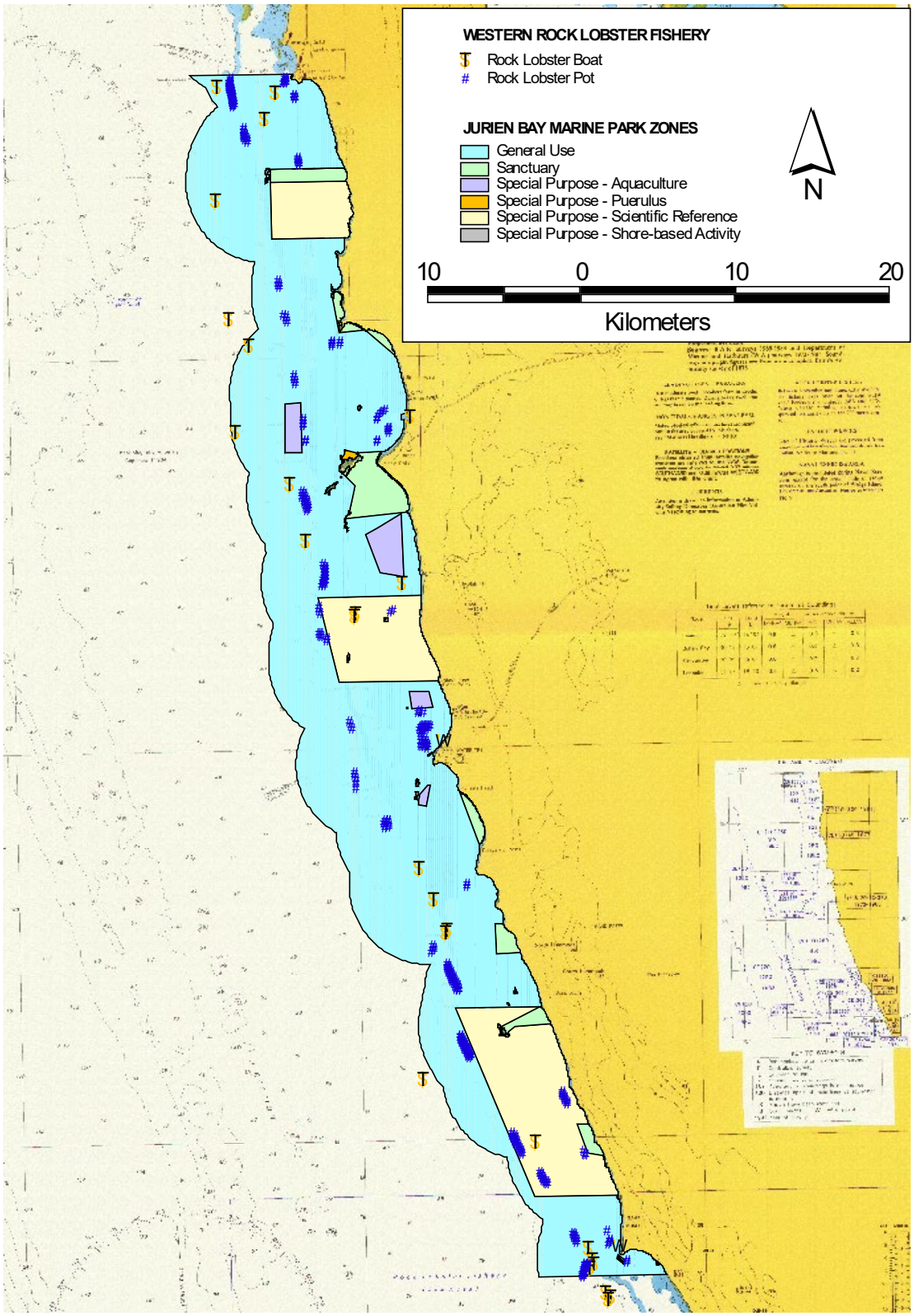

Figure 35 Distribution of commercial rock lobster vessels and pots adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04

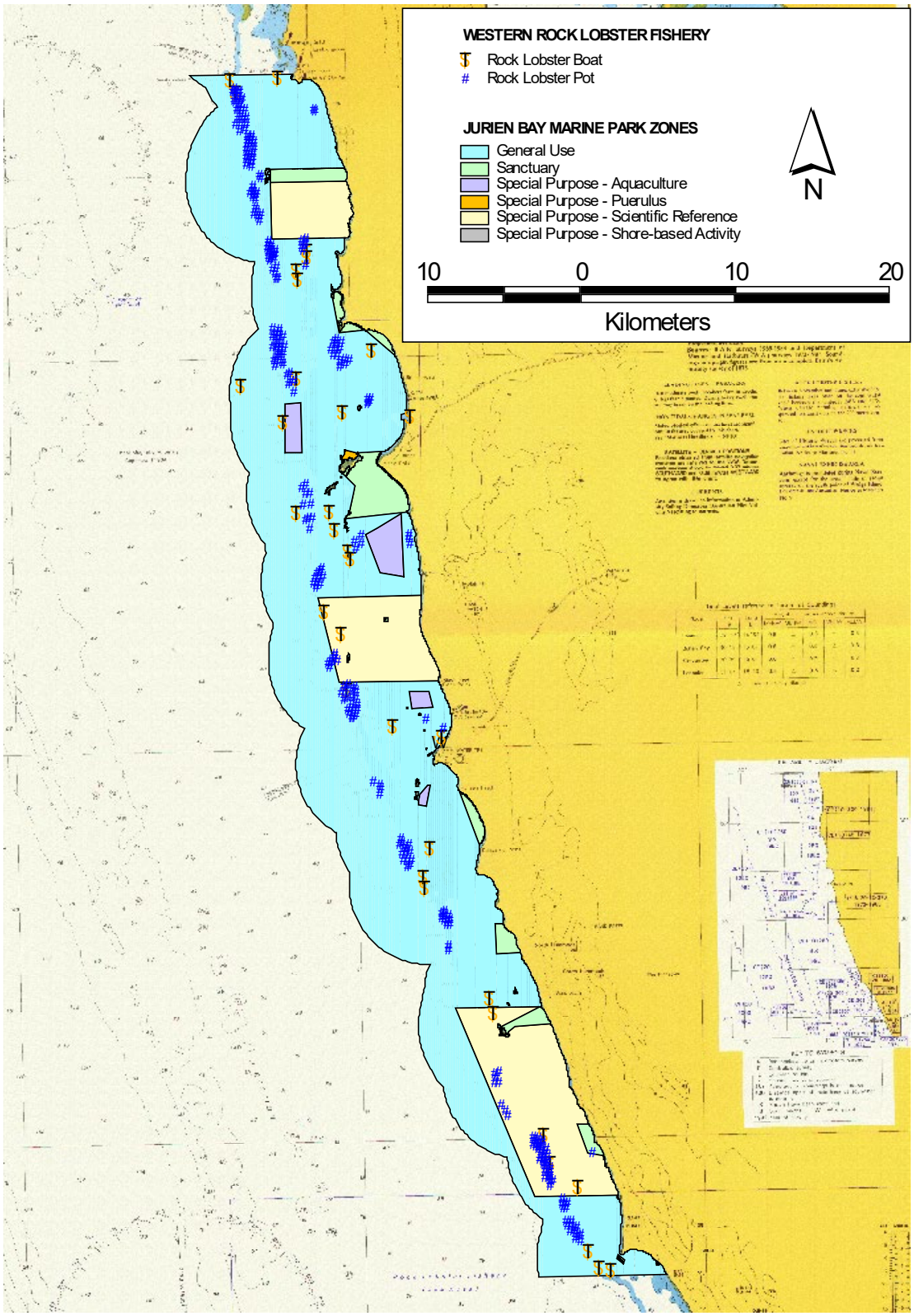

Figure 36 Distribution of commercial rock lobster vessels and pots adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 19/06/04

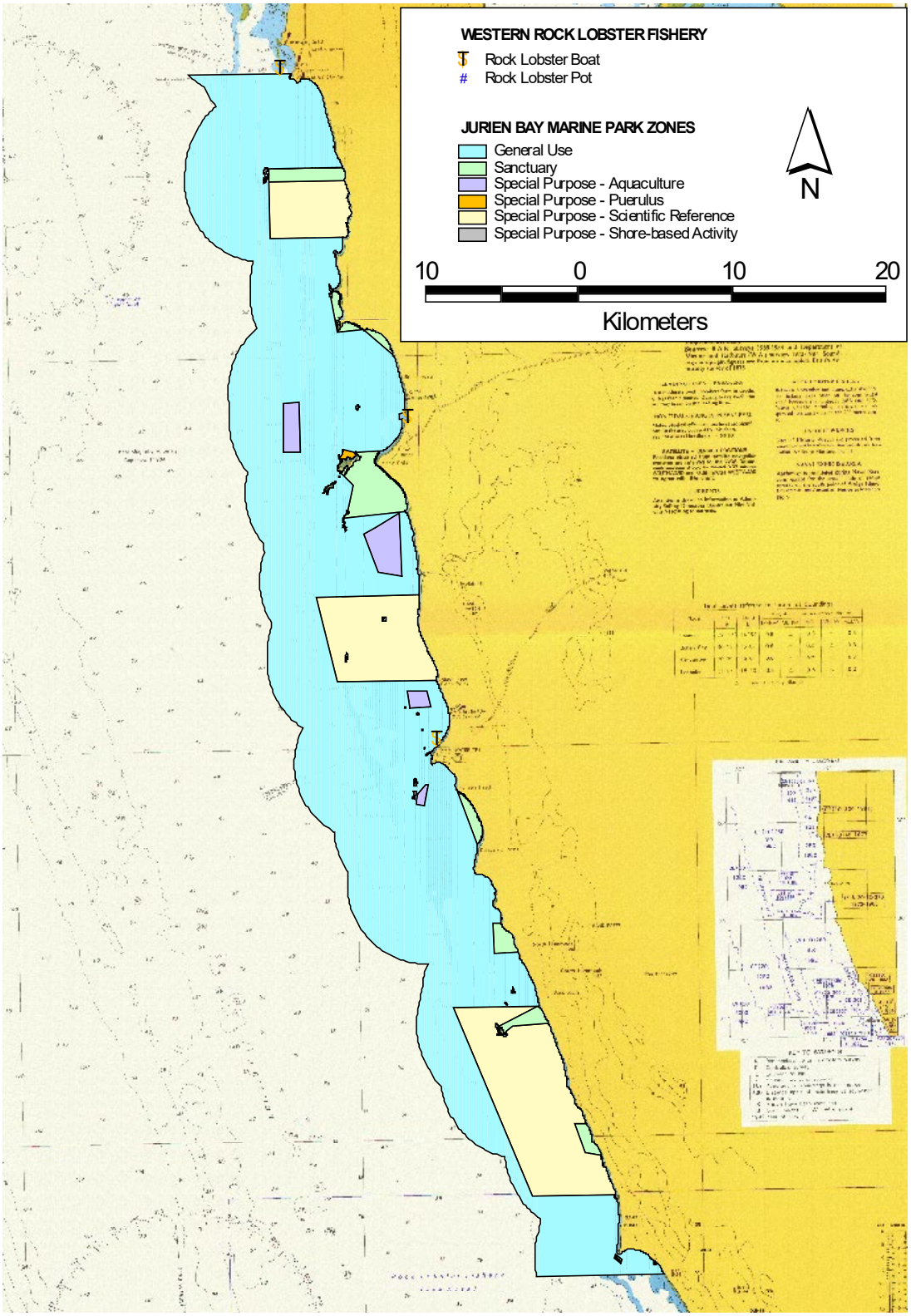

Figure 37 Distribution of commercial rock lobster vessels and pots adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 24/07/04

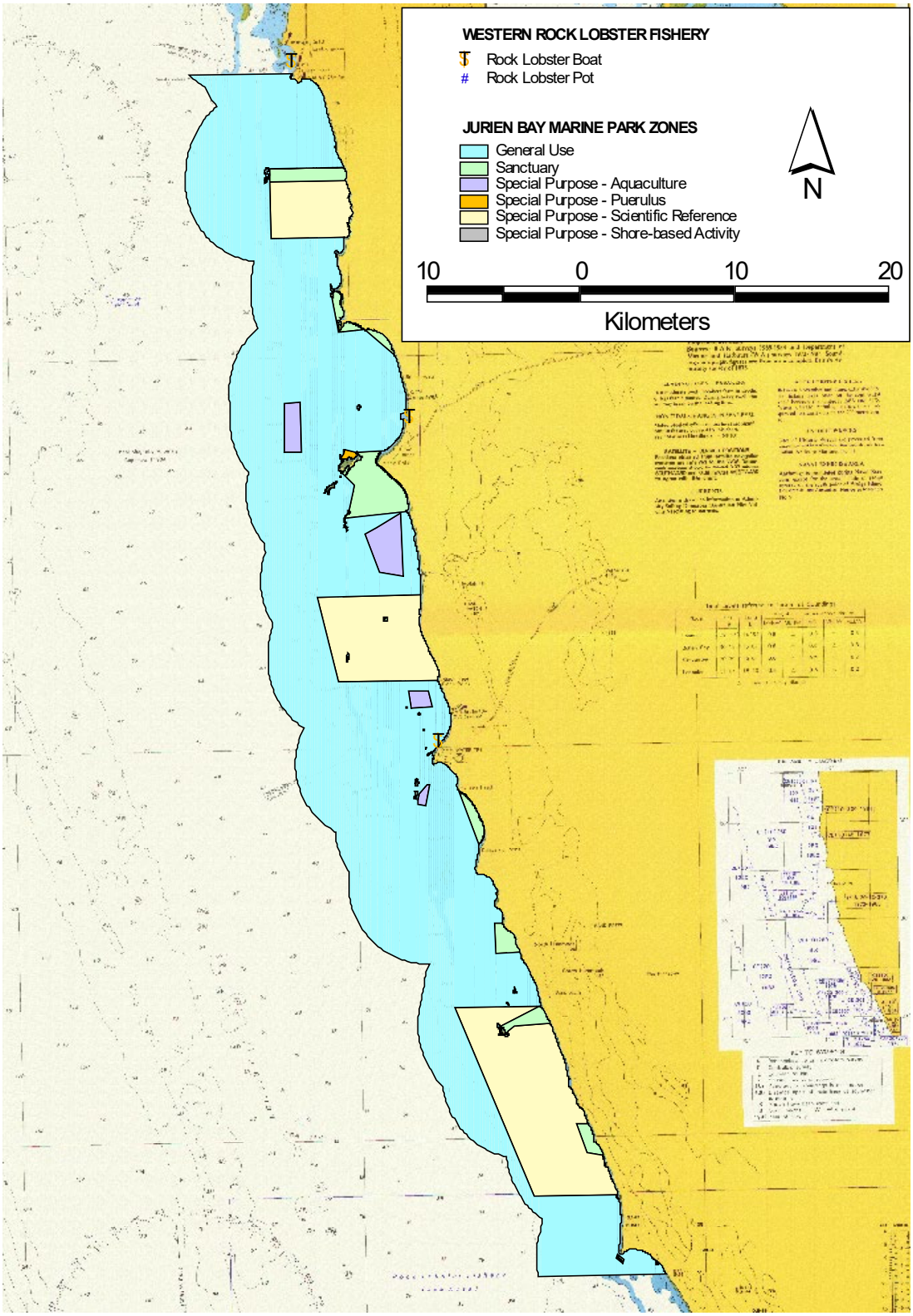

Figure 38 Distribution of commercial rock lobster vessels and pots adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 04/09/04

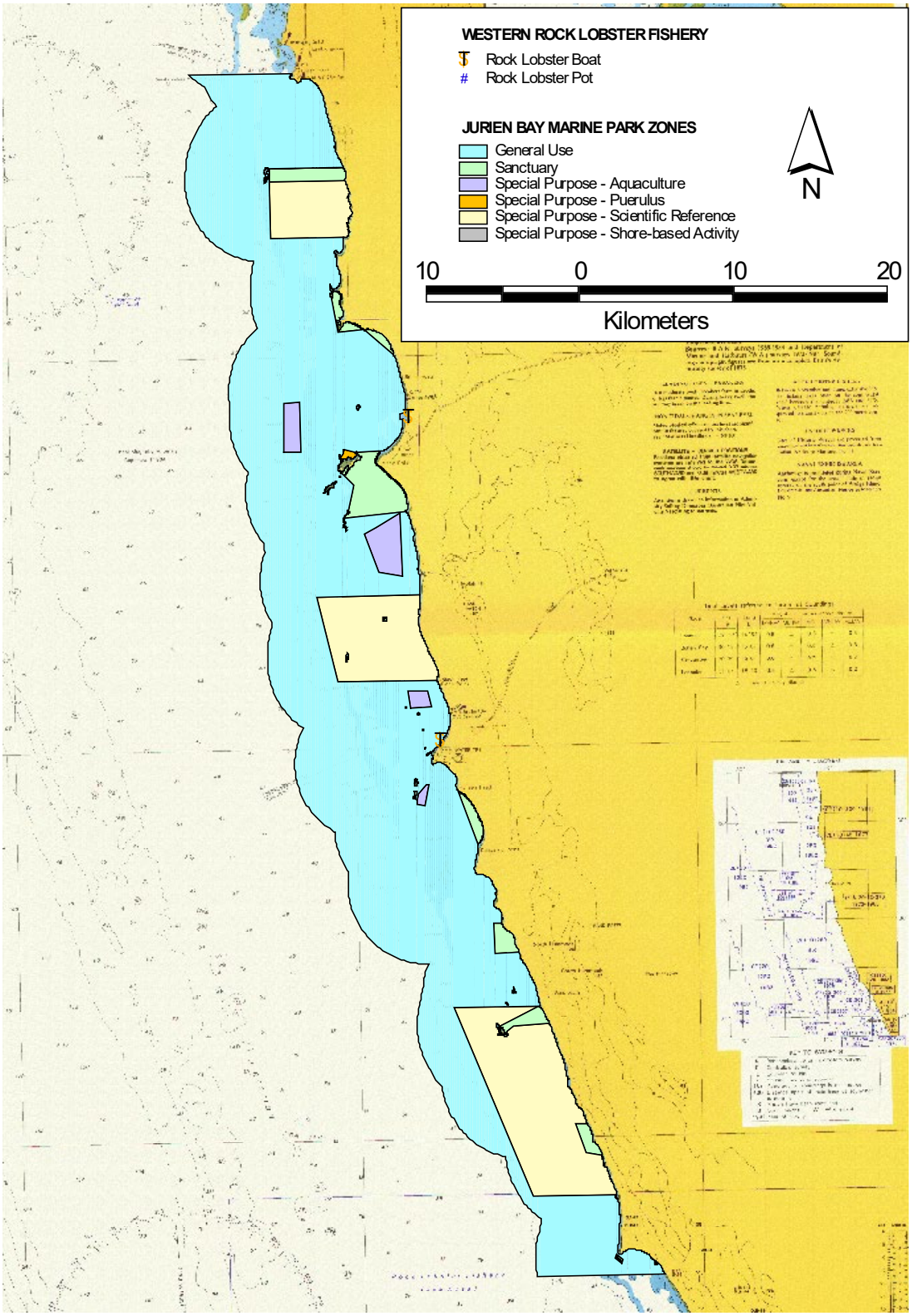

Figure 39 Distribution of commercial rock lobster vessels and pots adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 09/10/04

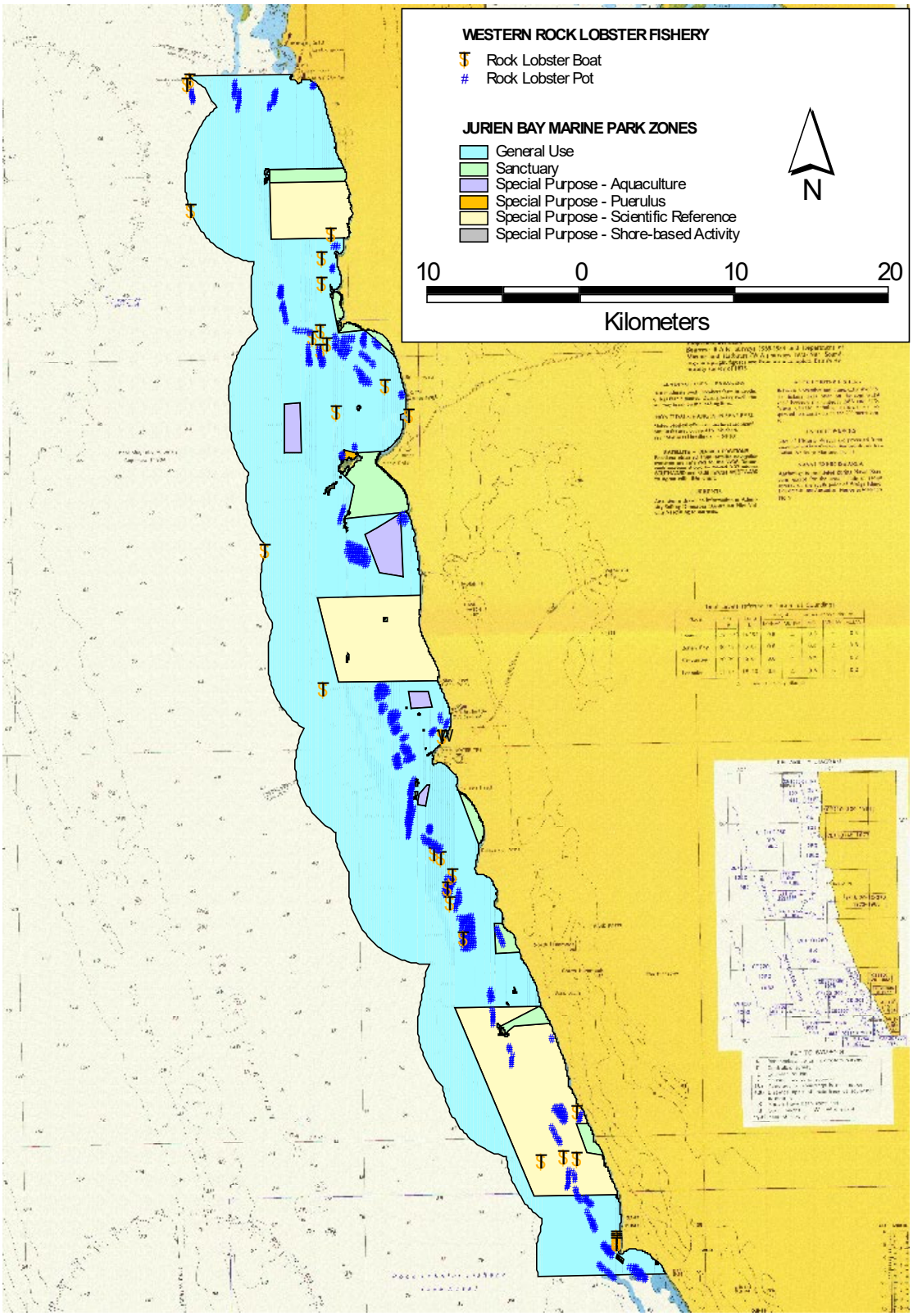

Figure 40 Distribution of commercial rock lobster vessels and pots adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 20/11/04

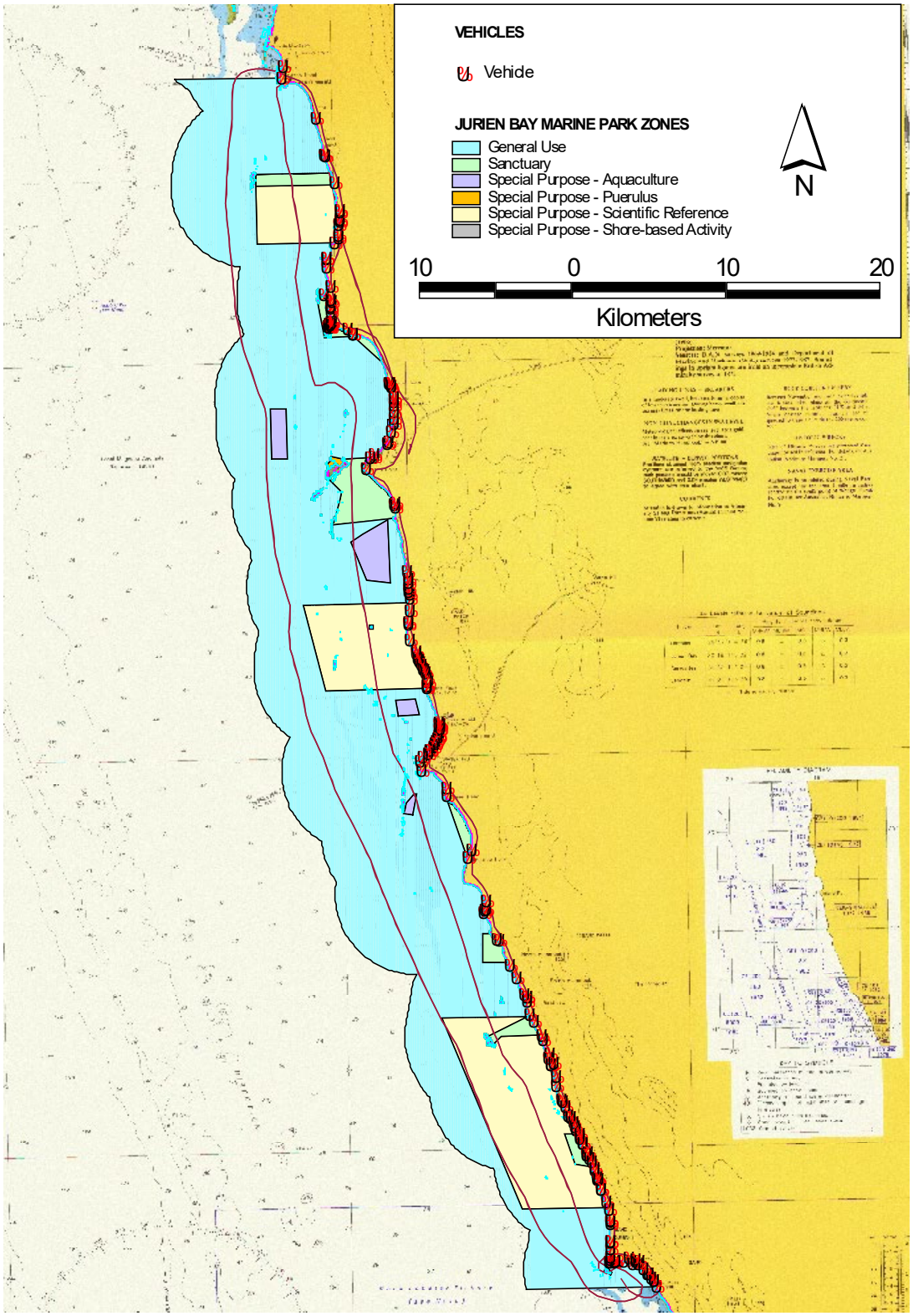

Figure 41 Distribution of vehicles adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04

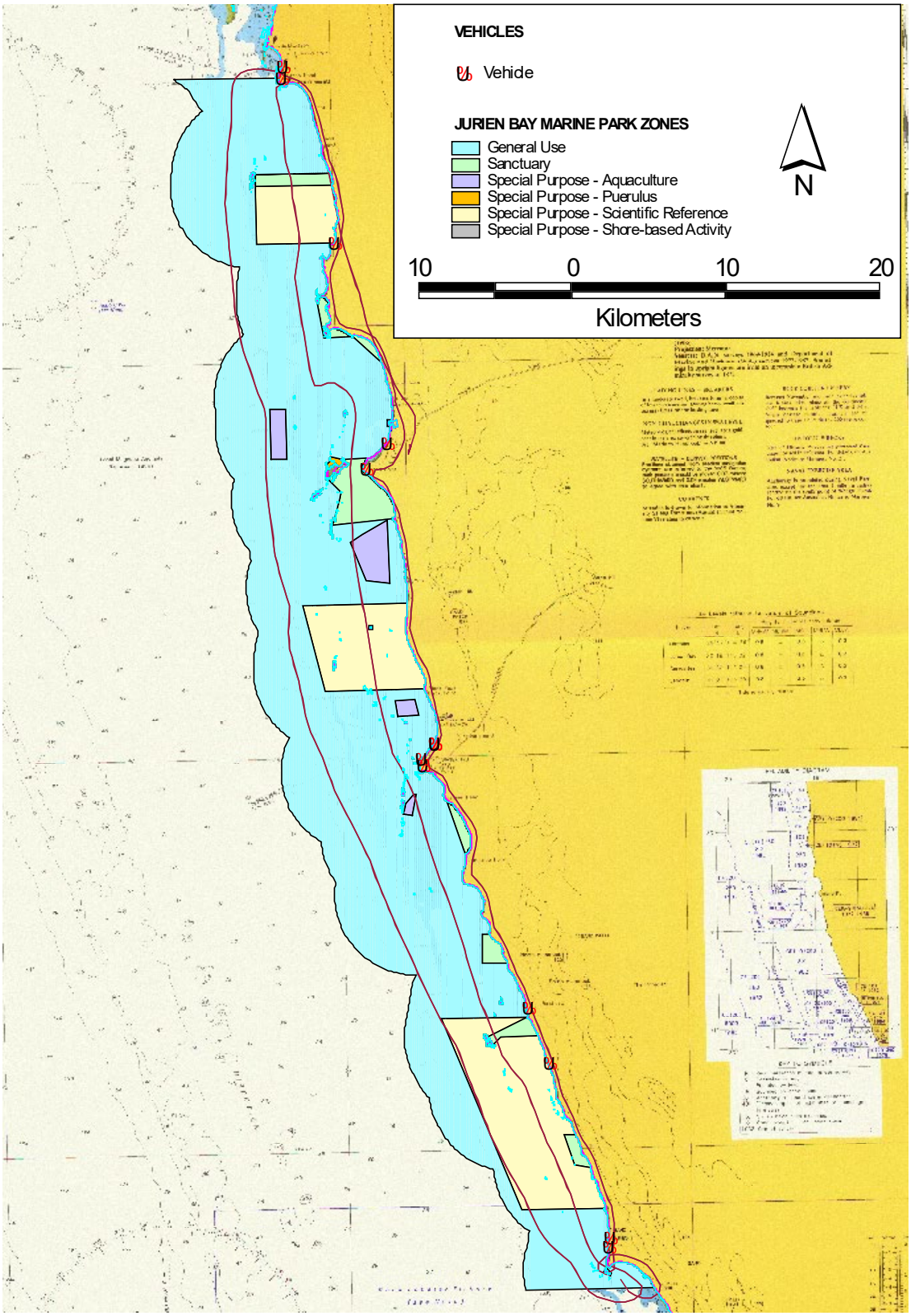

Figure 42 Distribution of vehicles adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 19/06/04

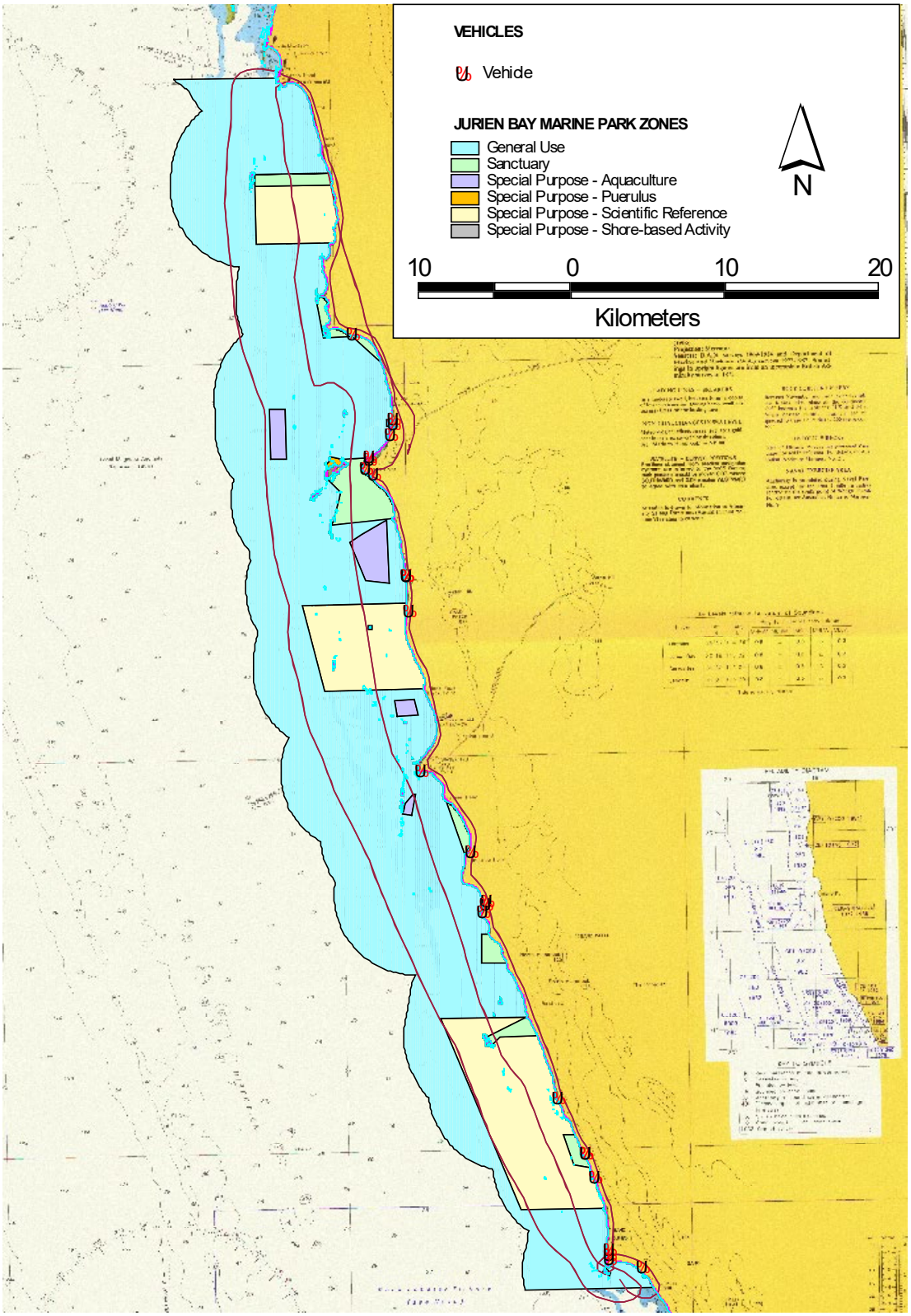

Figure 43 Distribution of vehicles adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 24/07/04

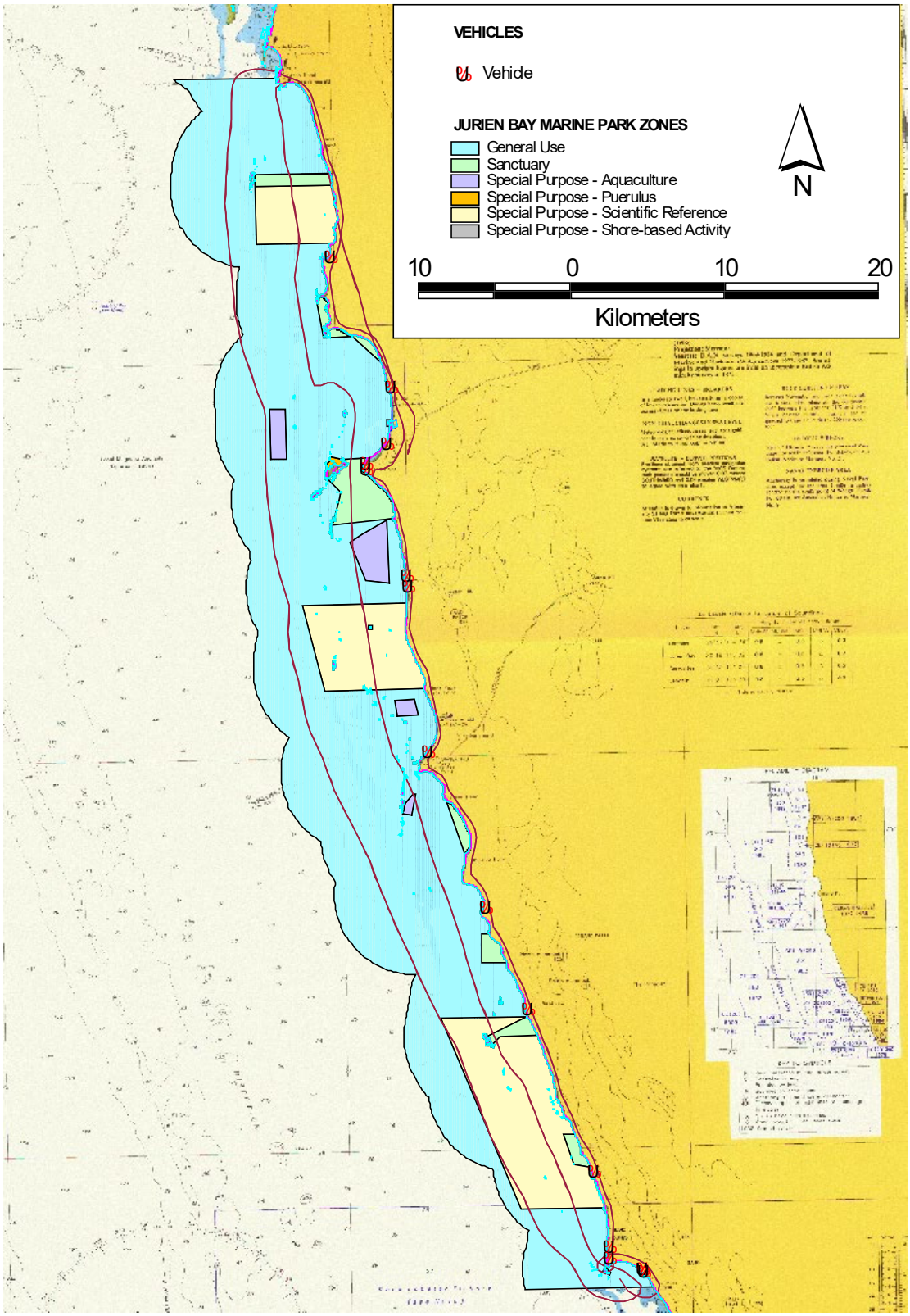

Figure 44 Distribution of vehicles adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 04/09/04

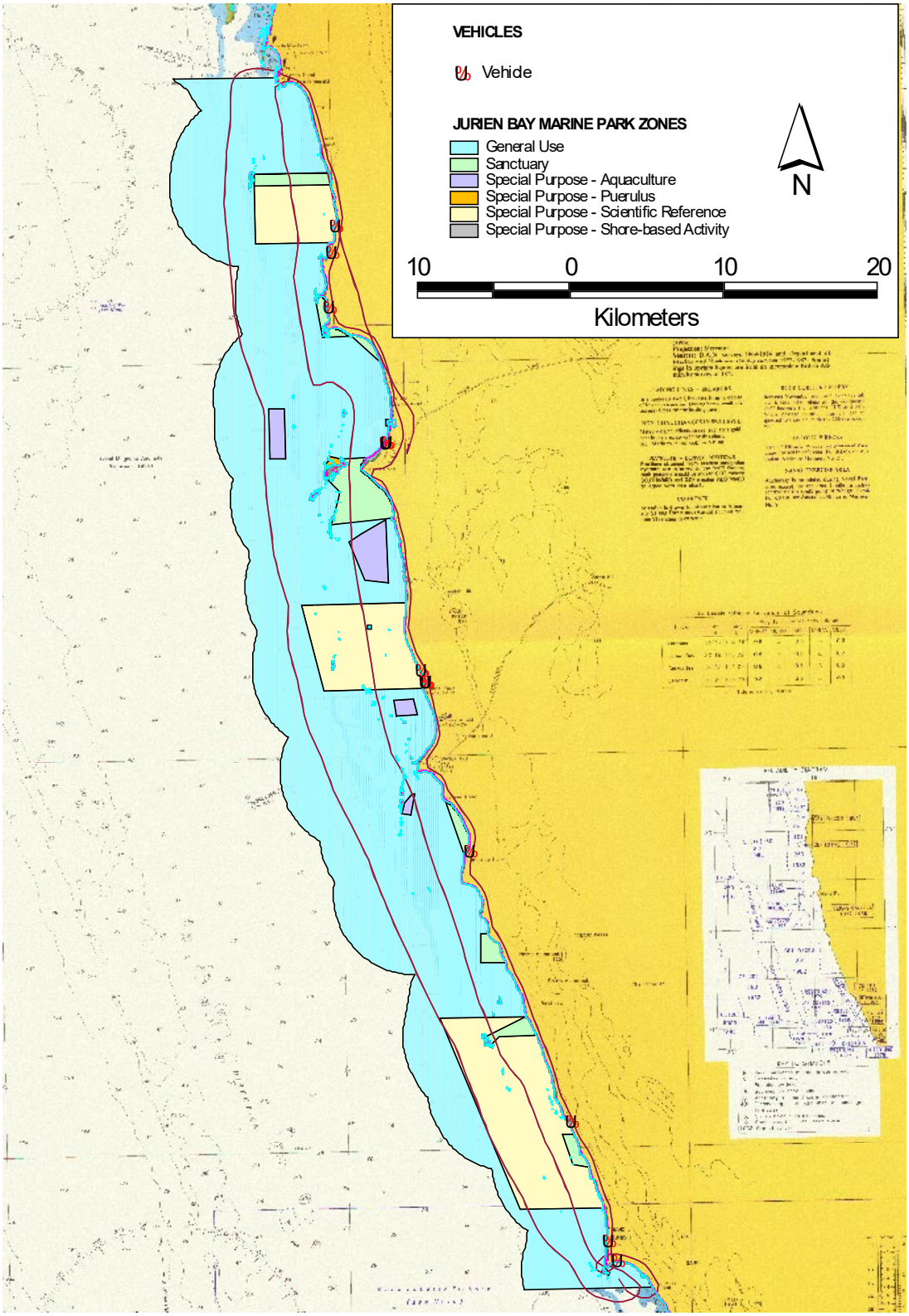

Figure 45 Distribution of vehicles adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 09/10/04

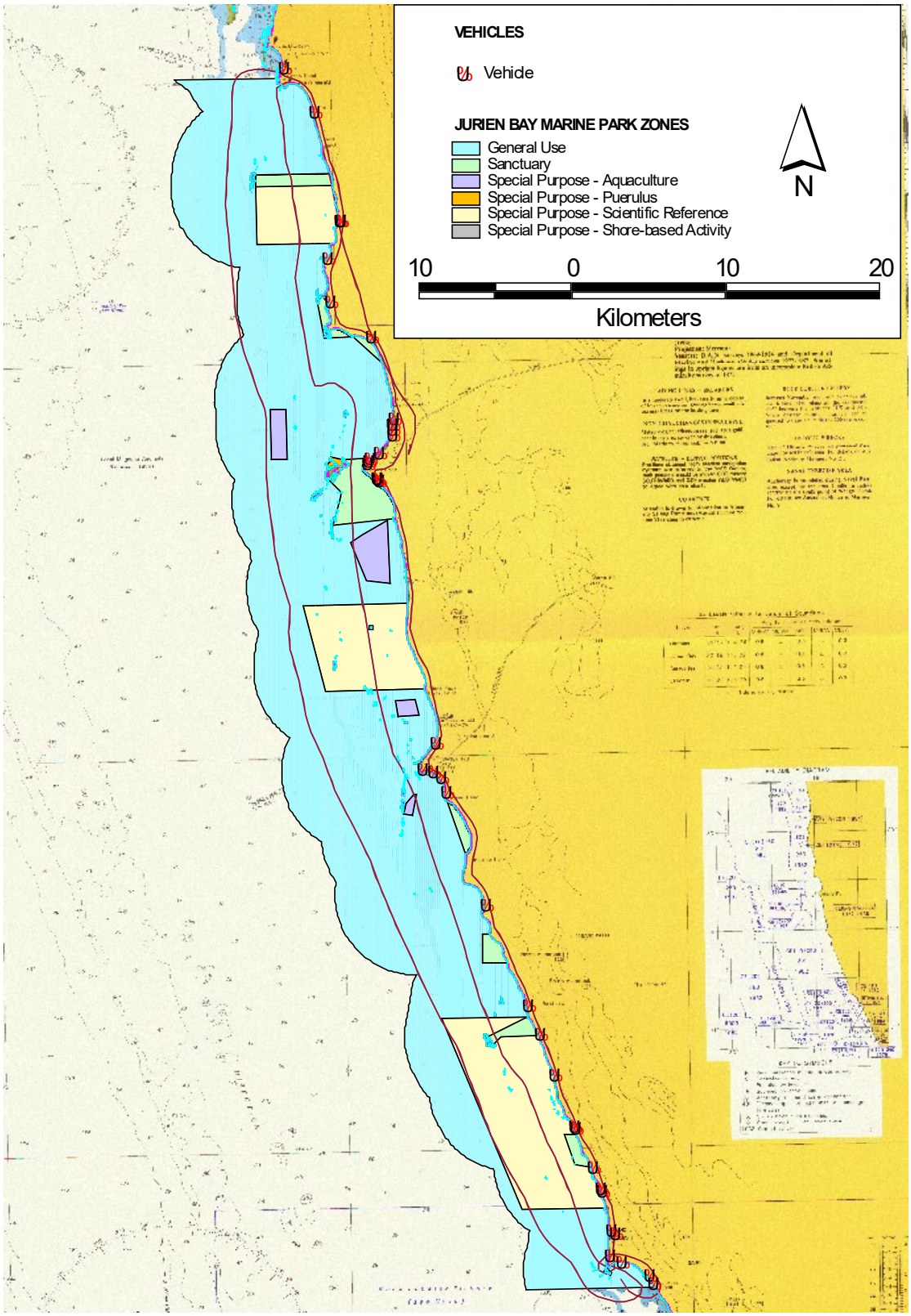

Figure 46 Distribution of vehicles adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 20/11/04

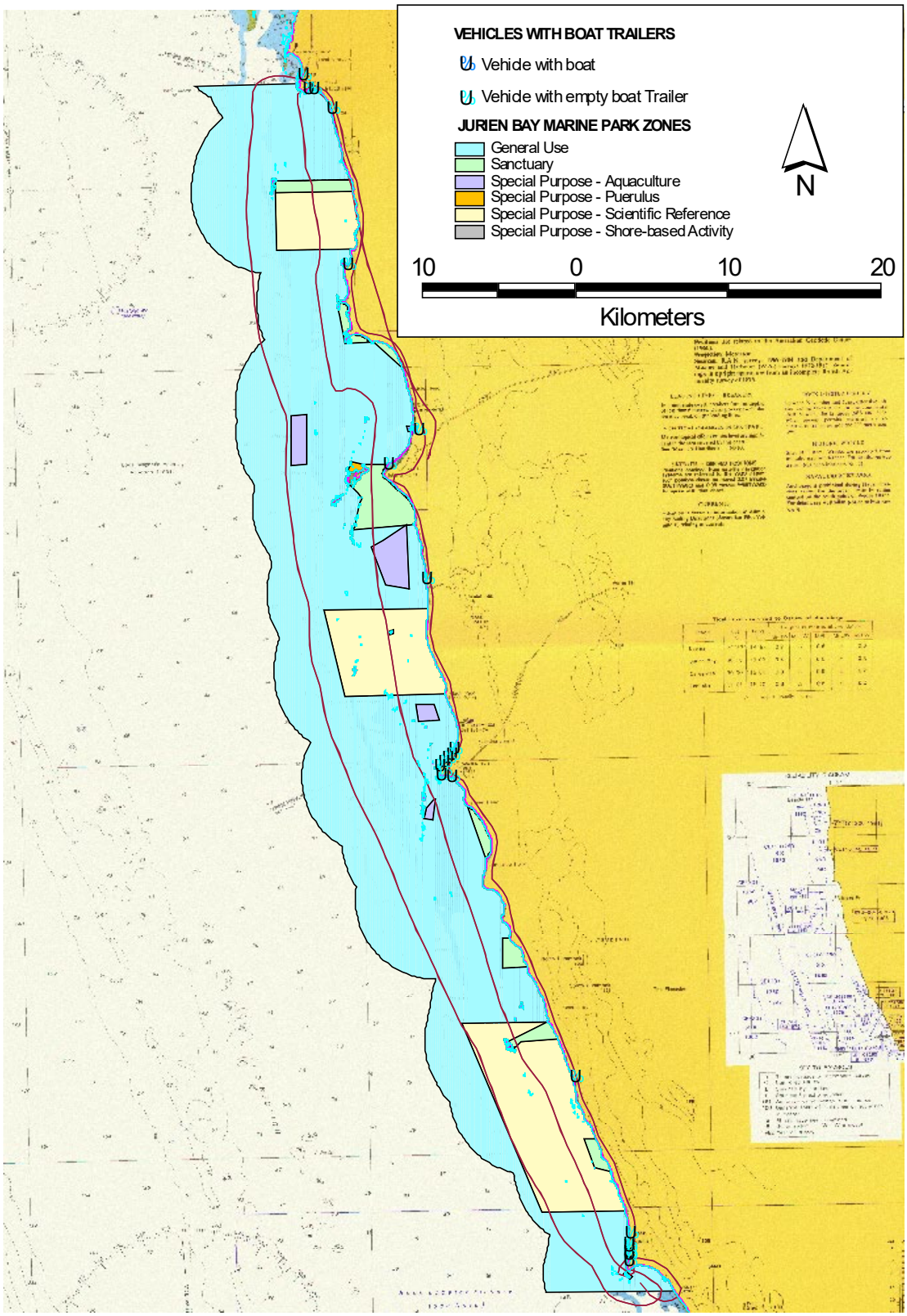

Figure 47 Distribution of vehicles with boat trailers adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 11/04/04

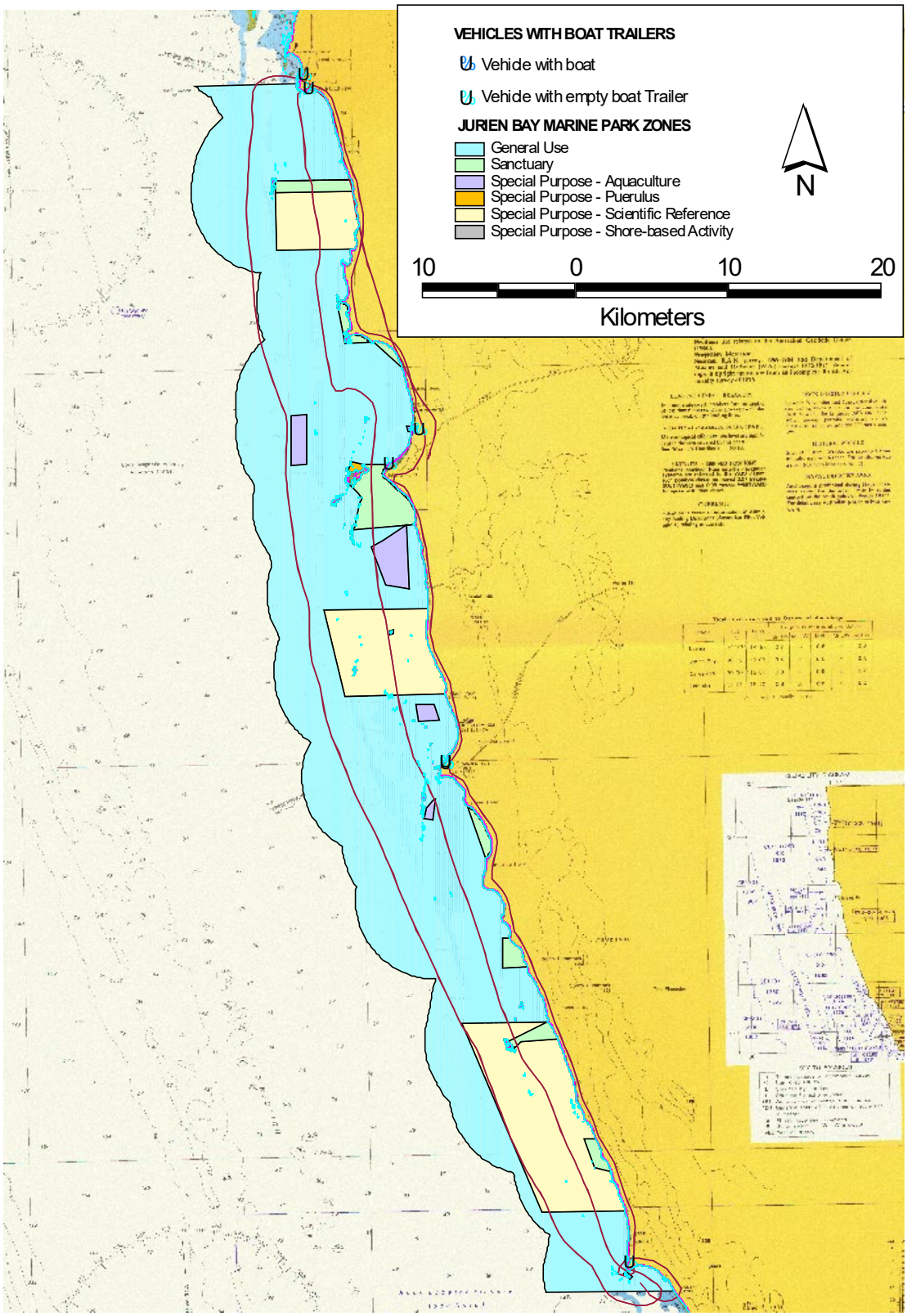

Figure 48 Distribution of vehicles with boat trailers adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 19/06/04

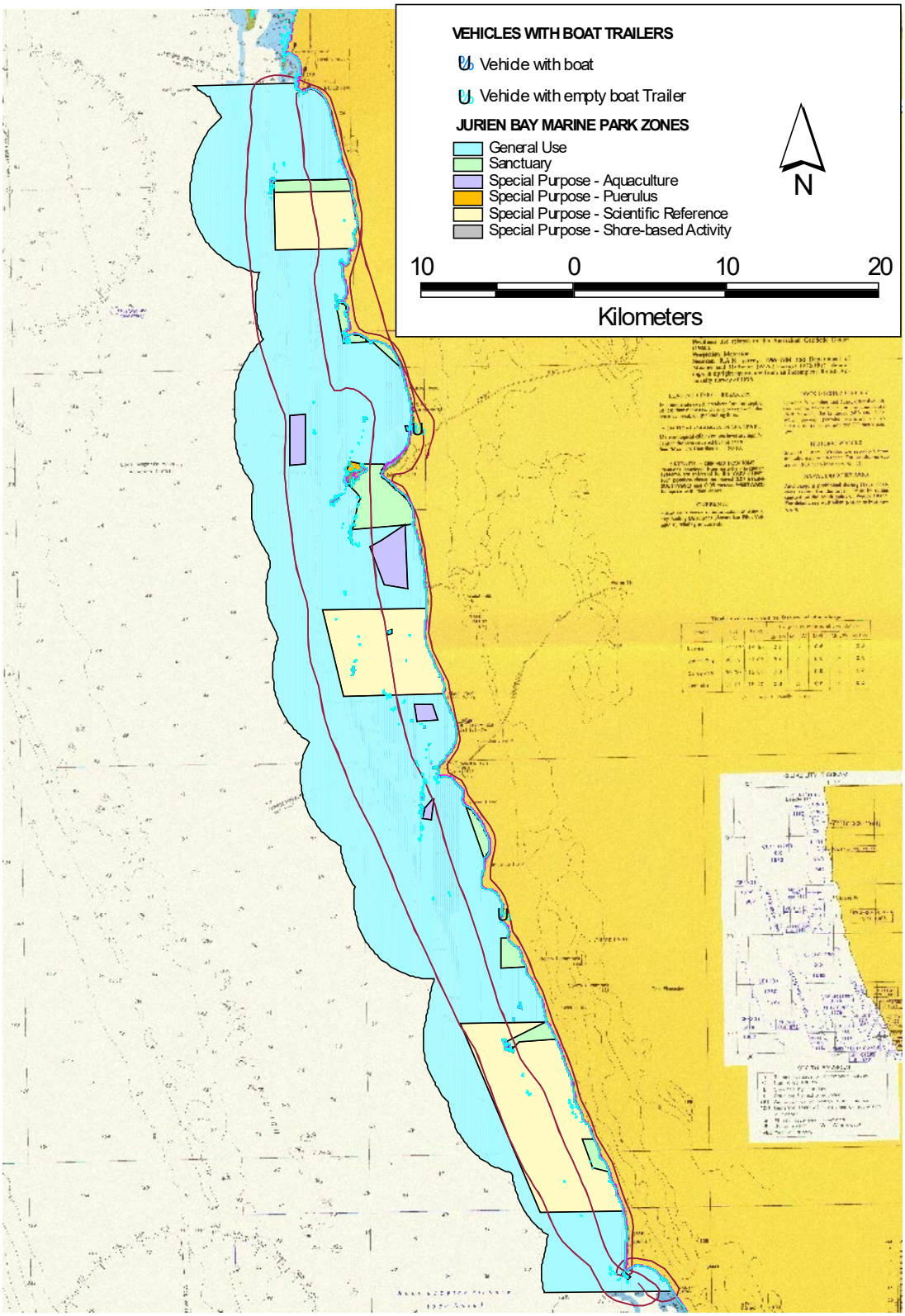

Figure 49 Distribution of vehicles with boat trailers adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 24/07/04

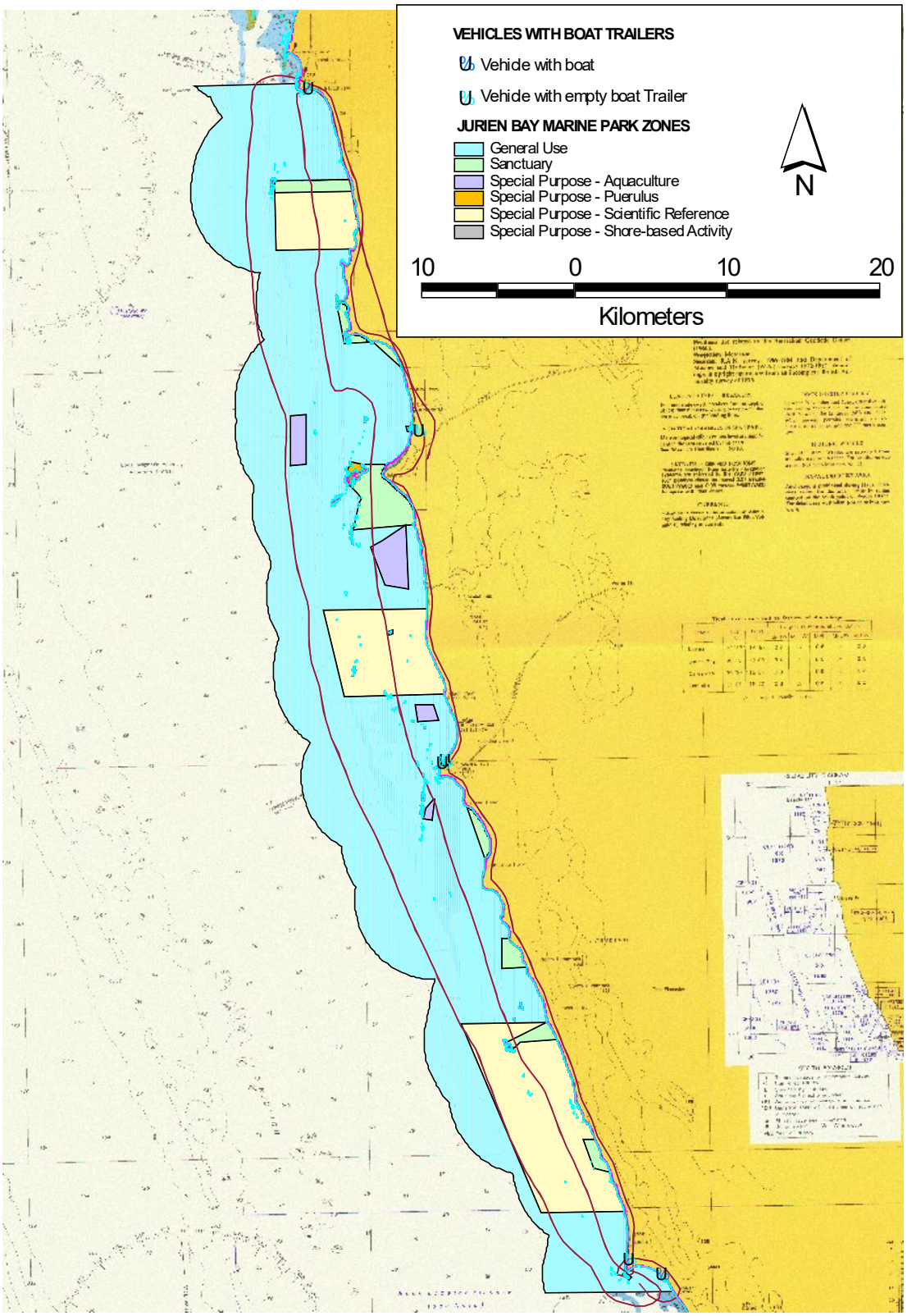

Figure 50 Distribution of vehicles with boat trailers adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 04/09/04

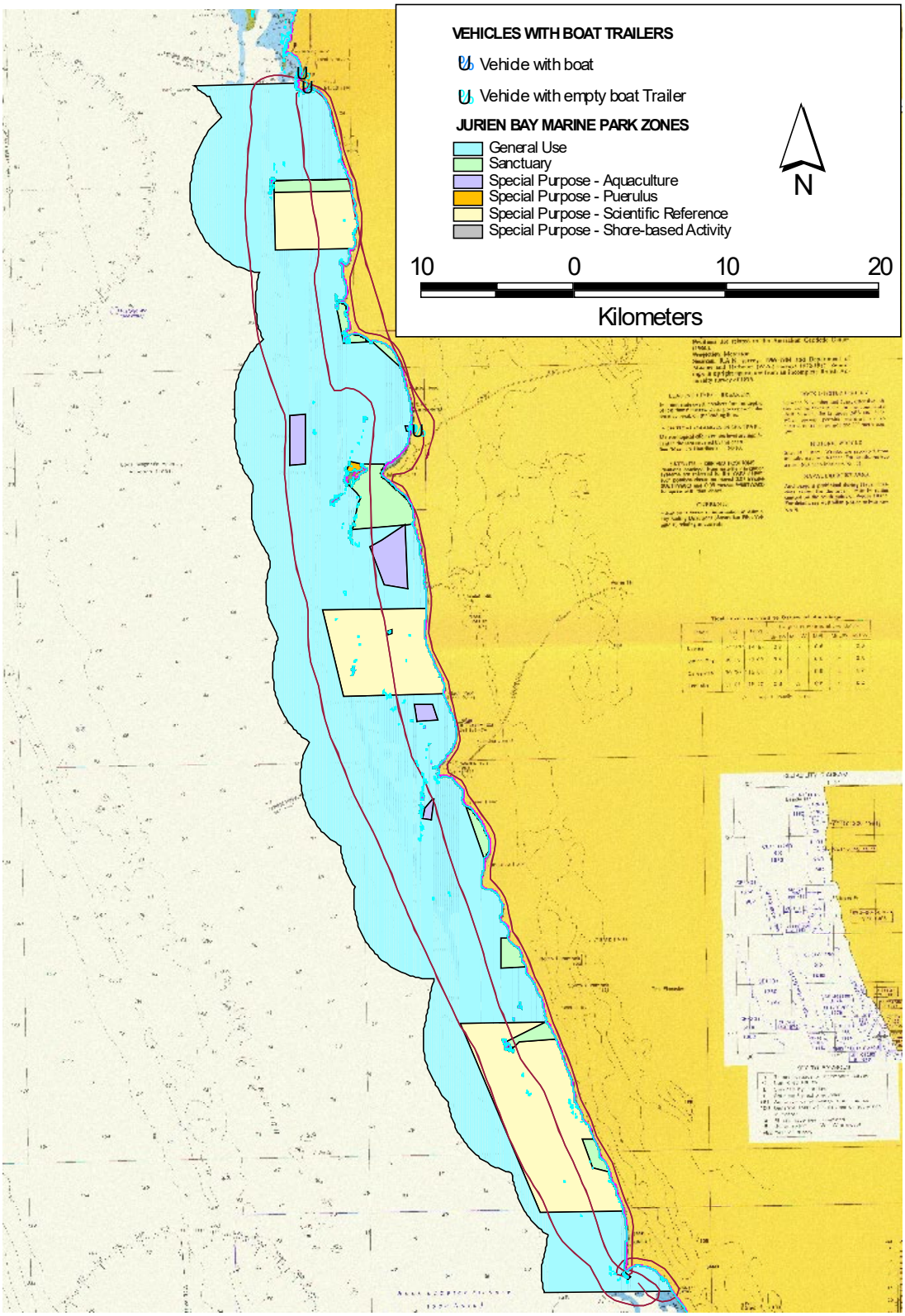

Figure 51 Distribution of vehicles with boat trailers adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 09/10/04

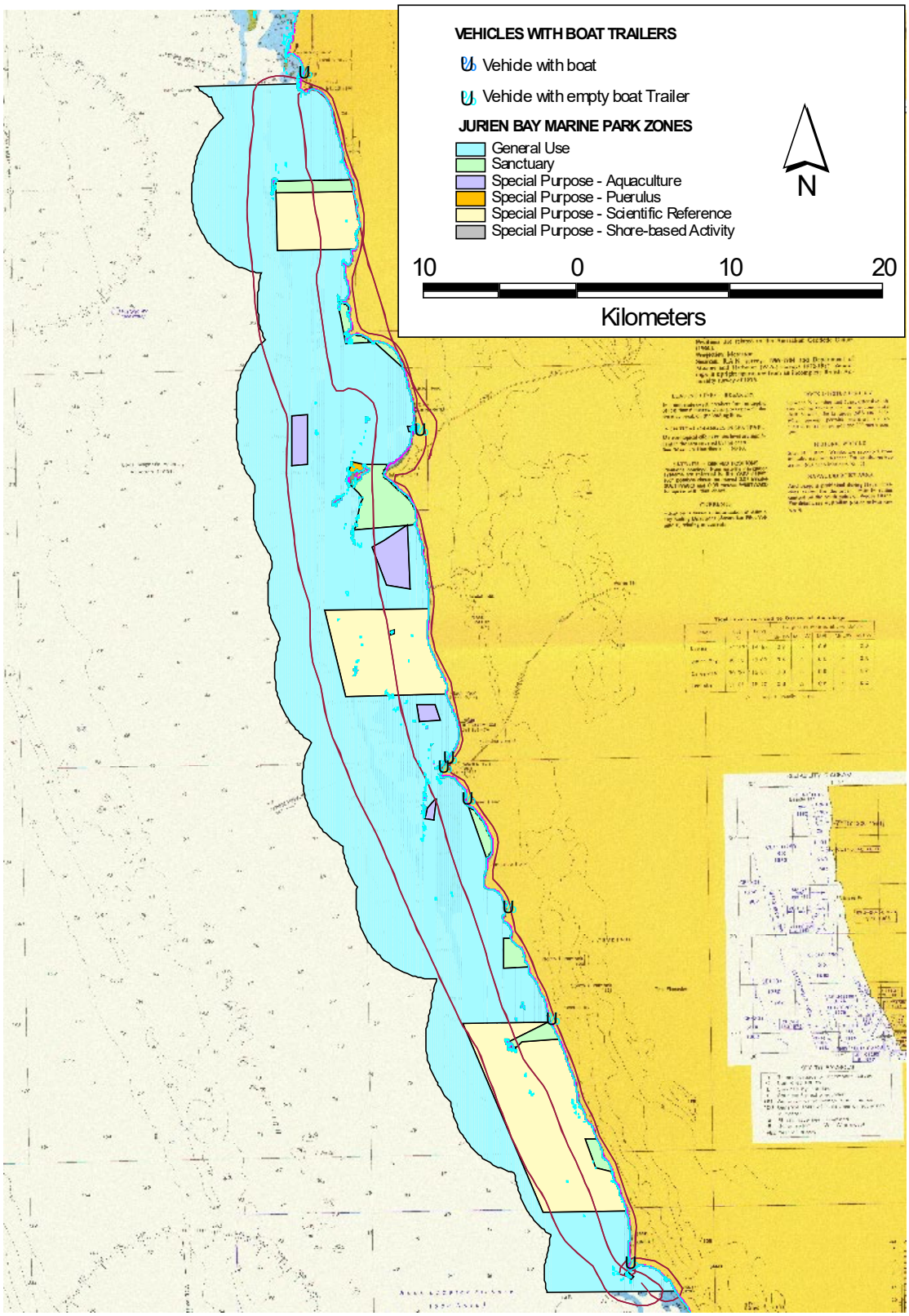

Figure 52 Distribution of vehicles with boat trailers adjacent to the Jurien Bay Marine Park as determined by aerial surveys conducted on 20/11/04

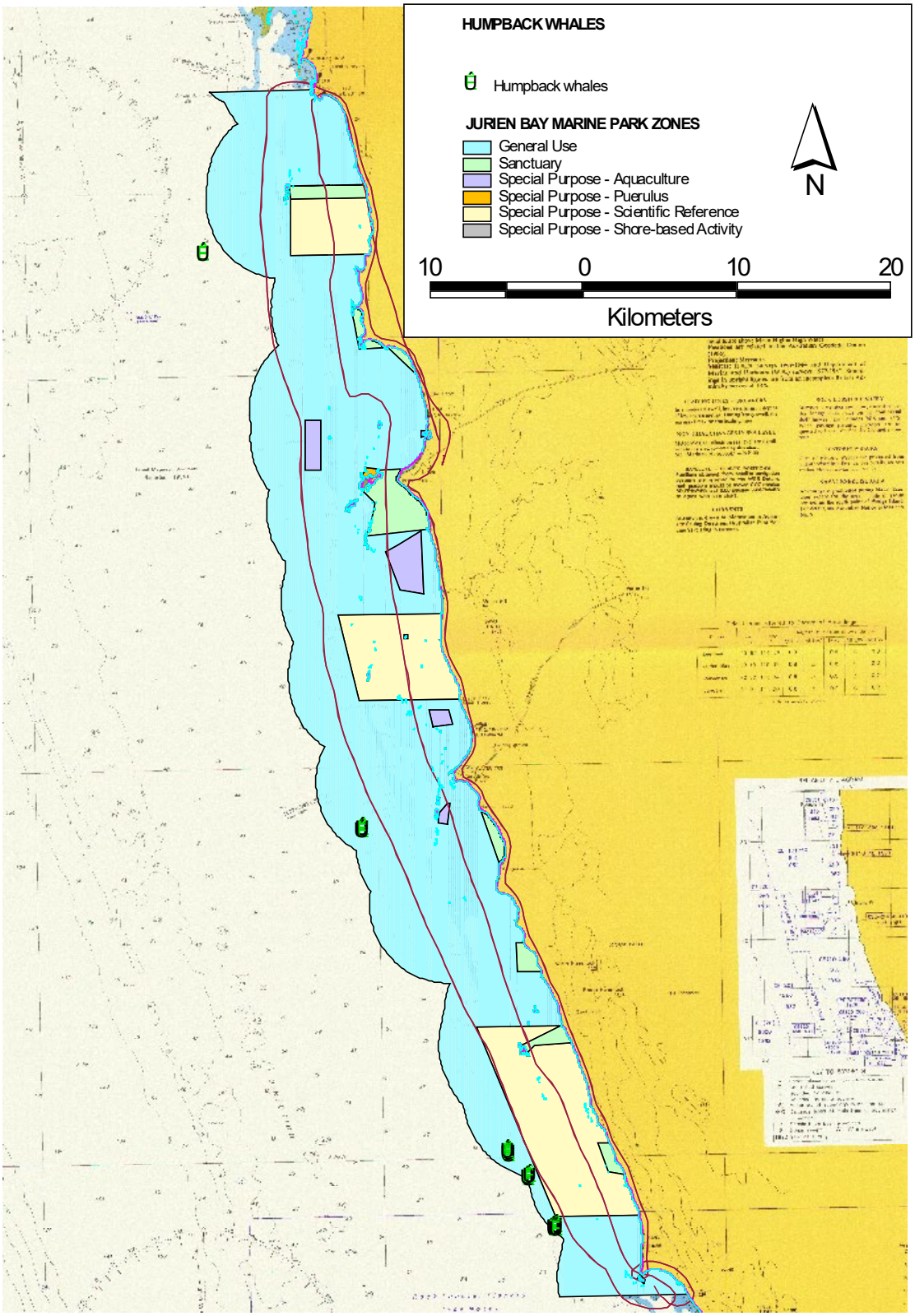

Figure 53 Distribution of marine wildlife adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 24/07/04

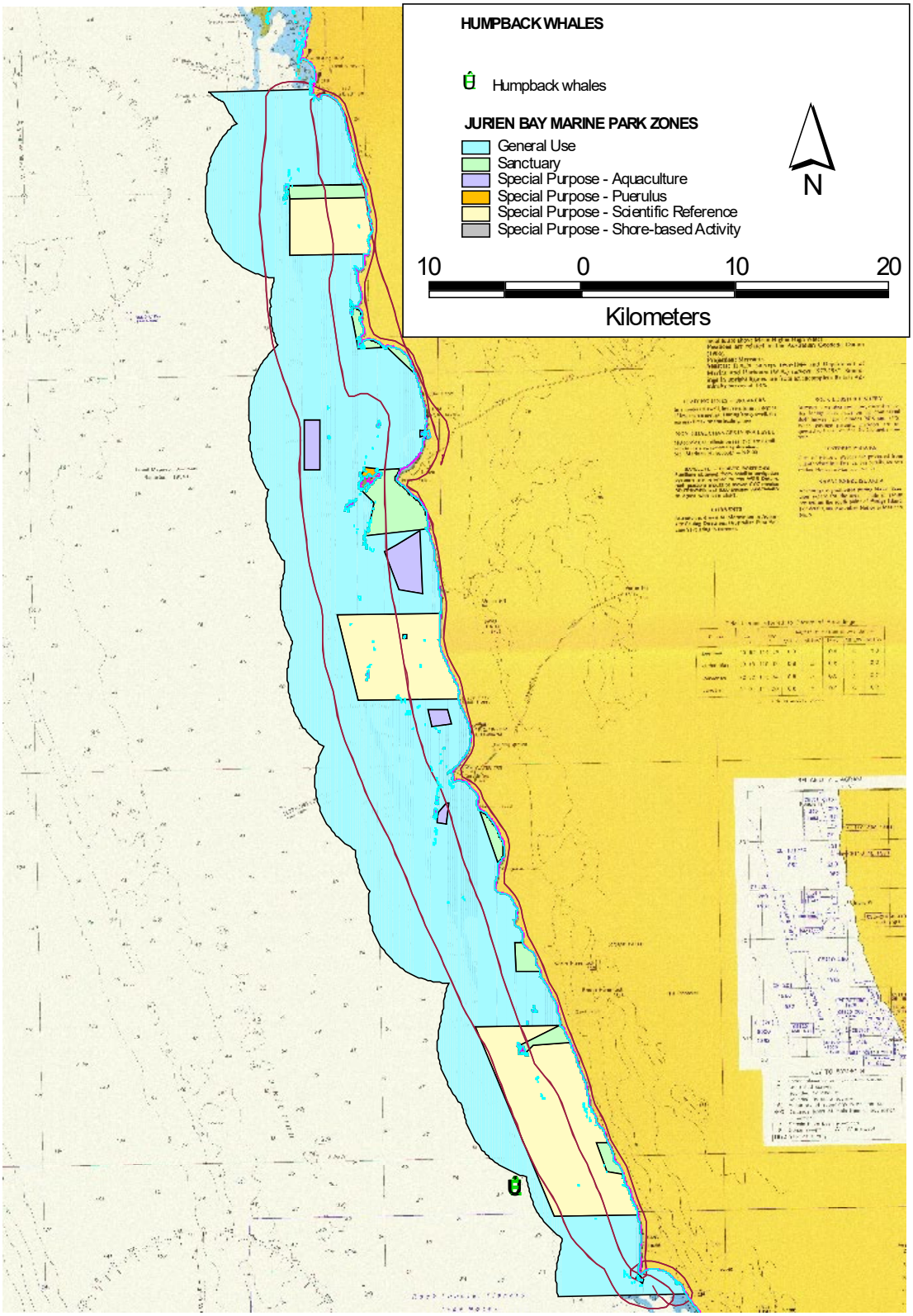

Figure 54 Distribution of marine wildlife adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 04/09/04

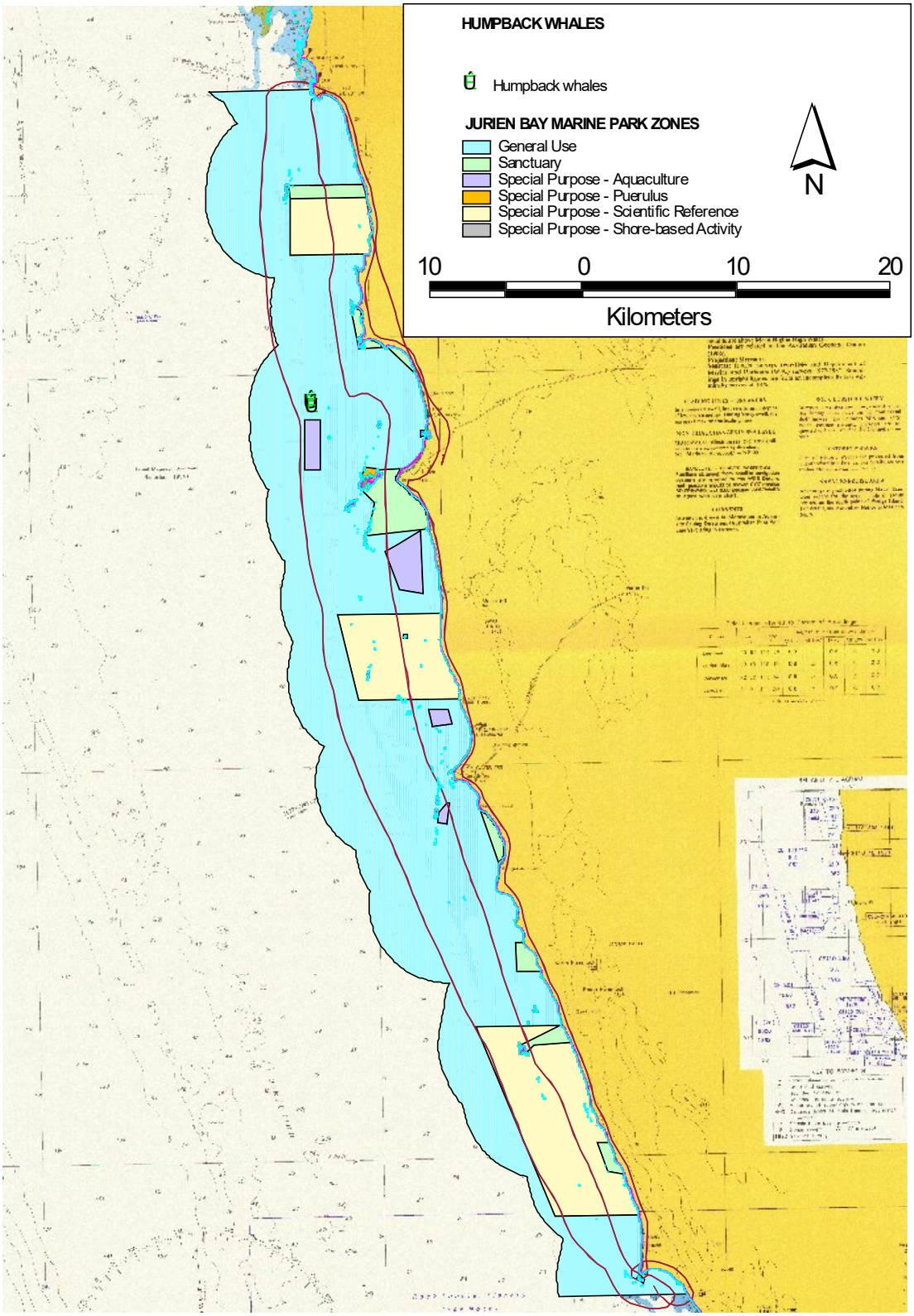

Figure 55 Distribution of marine wildlife adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 09/10/04

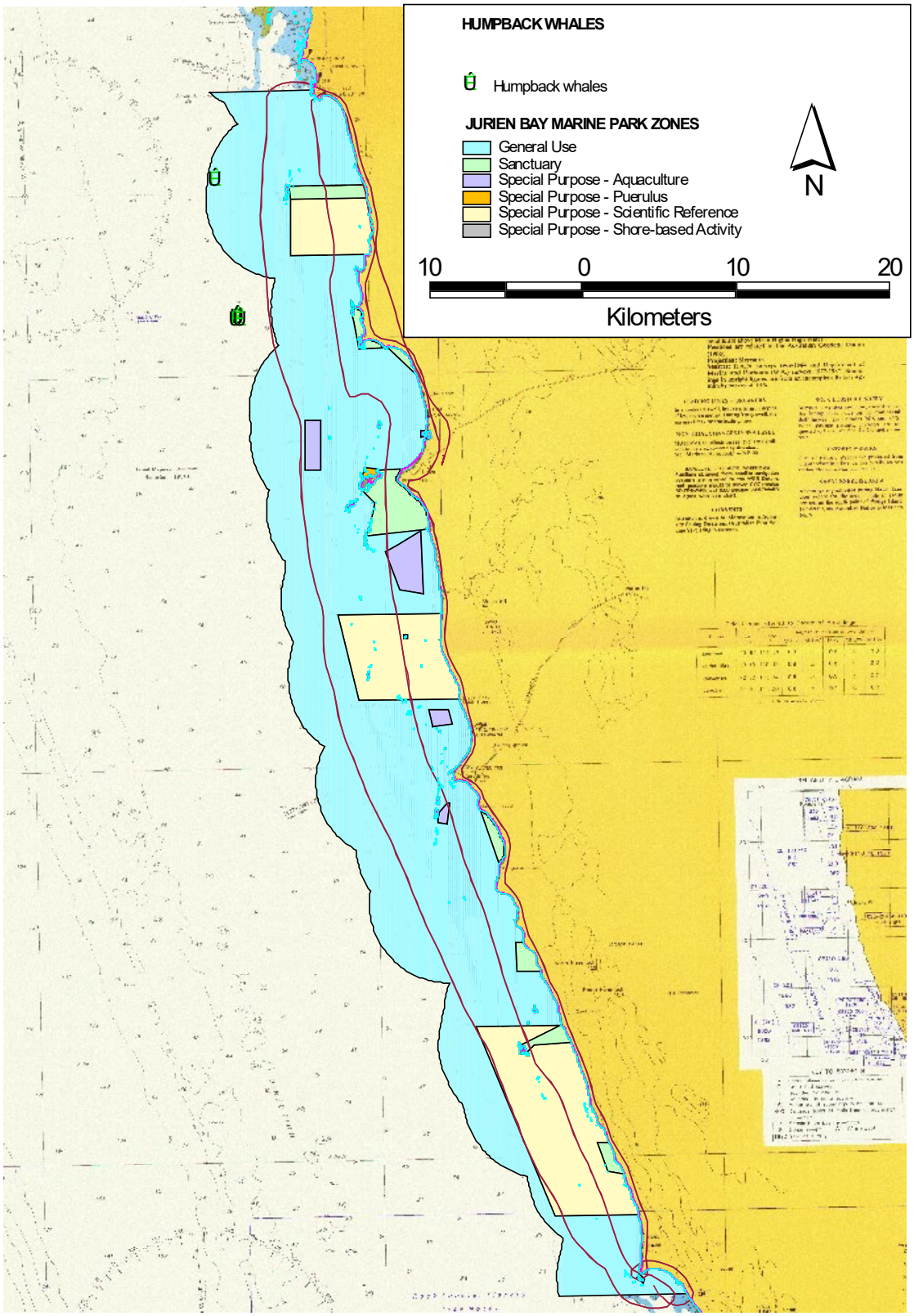

Figure 56 Distribution of marine wildlife adjacent to and within the Jurien Bay Marine Park as determined by aerial surveys conducted on 20/11/04

Table 10 Summary of human usage data for sectors 1-30 and outside the Park collected by aerial surveys during 2004.

Section 1	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	3		4	1	3	1
Rock Lobster Boat	1	2				2
Rock Lobster Pots	47	45				33
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife					1	
Grand Total	**51**	**47**	**4**	**1**	**4**	**36**

Section 2	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	3					
Charter Boat	1		1	1		
Motorbike	2					
Person						
PWC						
Recreational Boat	20		1		3	4
Rock Lobster Boat	2	1				
Rock Lobster Pots	18	2				20
Rock Lobster Tender boat						
Vehicle	21	1				1
Vehicle w boat Trailer	31	1		3	2	
Wildlife						
Grand Total	**98**	**5**	**2**	**4**	**5**	**25**

Section 3	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat			1			
Rock Lobster Boat						
Rock Lobster Pots		2				
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total		**2**	**1**			

Section 4	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	1					
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	1					
Rock Lobster Boat						
Rock Lobster Pots						
Rock Lobster Tender boat						
Vehicle	3					
Vehicle w boat Trailer						
Wildlife						
Grand Total	**5**					

Section 5	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	2			1		1
Rock Lobster Boat	1					1
Rock Lobster Pots	4	34				7
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total	**7**	**34**	**0**	**1**	**0**	**9**

Section 6	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	87	3	3	9	7	11
Charter Boat						
Motorbike					1	
Person						
PWC						
Recreational Boat	9		1	2	2	
Rock Lobster Boat		4				3
Rock Lobster Pots		7				9
Rock Lobster Tender boat						
Vehicle	51	1		2	2	5
Vehicle w boat Trailer	2					
Wildlife						
Grand Total	**149**	**15**	**4**	**13**	**12**	**28**

Section 7	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	4			4		
Rock Lobster Boat	2					
Rock Lobster Pots	4	23				22
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife					3	
Grand Total	**10**	**23**	**0**	**4**	**3**	**22**

Section 8	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	35				1	3
Charter Boat	1					
Motorbike						
Person						
PWC						
Recreational Boat	7			3	1	
Rock Lobster Boat		1				4
Rock Lobster Pots	6	14				100
Rock Lobster Tender boat						
Vehicle	59		1		2	2
Vehicle w boat Trailer						
Wildlife						
Grand Total	**108**	**15**	**1**	**3**	**4**	**109**

Section 9	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	12				3	
Rock Lobster Boat	1	3				
Rock Lobster Pots	10	6				
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						2
Grand Total	**23**	**9**	**0**	**0**	**3**	**2**

Section 10	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	3					
Charter Boat	1					
Motorbike						
Person		3		4		3
PWC						
Recreational Boat	29	4	4	4	3	5
Rock Lobster Boat	9	7	12	7	8	12
Rock Lobster Pots	12	4				23
Rock Lobster Tender boat						
Vehicle	35	1	5	4	4	8
Vehicle w boat Trailer	70	16	15	4	4	13
Wildlife						
Grand Total	**159**	**35**	**36**	**23**	**19**	**64**

Section 11	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	7	1	1			
Rock Lobster Boat	1	9				
Rock Lobster Pots	16					
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total	**24**	**10**	**1**			

Section 12	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	2					
Charter Boat				1	1	
Motorbike						
Person	4	6				
PWC						
Recreational Boat	6	2	1	5		
Rock Lobster Boat		1				
Rock Lobster Pots						9
Rock Lobster Tender boat						
Vehicle	9	1	4	3		6
Vehicle w boat Trailer		1				
Wildlife						
Grand Total	**21**	**11**	**5**	**9**	**1**	**15**

Section 13	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat					1	
Motorbike						
Person						
PWC						
Recreational Boat	1		1	1		1
Rock Lobster Boat	1					1
Rock Lobster Pots	20	11				
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total	**22**	**11**	**1**	**1**	**1**	**2**

Section 14	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	6	1		1		
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	1		1			
Rock Lobster Boat	1	3				
Rock Lobster Pots		7				68
Rock Lobster Tender boat						
Vehicle	12		3	2		
Vehicle w boat Trailer	1					
Wildlife						
Grand Total	**21**	**11**	**4**	**3**		**68**

Section 15	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	1				1	
Rock Lobster Boat		2				
Rock Lobster Pots	9	8				
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total	**10**	**10**			**1**	

Section 16	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	22				1	
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	1					
Rock Lobster Boat	2					
Rock Lobster Pots	2					
Rock Lobster Tender boat						
Vehicle	56		4		3	
Vehicle w boat Trailer						
Wildlife						
Grand Total	**83**		**4**		**4**	

Section 17	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	1	1	2		1	2
Rock Lobster Boat		1				1
Rock Lobster Pots	3	21				
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total	**4**	**23**	**2**		**1**	**3**

Section 18	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	1					
Charter Boat						
Motorbike						
Person		4	4	4	2	
PWC						
Recreational Boat	9		4		4	2
Rock Lobster Boat		10	10	8	1	15
Rock Lobster Pots	31	11				120
Rock Lobster Tender boat	28	11				6
Vehicle	32	4	3	1		7
Vehicle w boat Trailer	118	12		2		10
Wildlife						
Grand Total	**219**	**52**	**21**	**15**	**7**	**160**

Section 19	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	23		2			
Rock Lobster Boat	1					
Rock Lobster Pots	13	18				23
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total	**37**	**18**	**2**			**23**

Section 20	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						1
Recreational Boat	9	1			1	2
Rock Lobster Boat		1				2
Rock Lobster Pots						77
Rock Lobster Tender boat						
Vehicle	6		1		2	6
Vehicle w boat Trailer						1
Wildlife						
Grand Total	**15**	**2**	**1**		**3**	**89**

Section 21	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat	1					
Motorbike						
Person						
PWC						
Recreational Boat	9			1		
Rock Lobster Boat	3	2				
Rock Lobster Pots	4	7				
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total	**17**	**9**		**1**		

Section 22	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						1
Person	7					
PWC	2					
Recreational Boat	1		2			3
Rock Lobster Boat						4
Rock Lobster Pots	2	5				135
Rock Lobster Tender boat						
Vehicle	8		3	1		1
Vehicle w boat Trailer			1			1
Wildlife						
Grand Total	**20**	**5**	**6**	**1**		**145**

Section 23	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat	1					
Motorbike						
Person						
PWC						
Recreational Boat						
Rock Lobster Boat						
Rock Lobster Pots	30					
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total	**31**					

Section 24	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	2					
Charter Boat						
Motorbike						1
Person	22					
PWC						
Recreational Boat	16					5
Rock Lobster Boat		1				
Rock Lobster Pots						10
Rock Lobster Tender boat						
Vehicle	8	6		1		3
Vehicle w boat Trailer						10
Wildlife						
Grand Total	**48**	**7**		**1**		**29**

Section 25	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	3					5
Rock Lobster Boat						
Rock Lobster Pots	34	5				
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife						
Grand Total	**37**	**5**				**5**

Section 26	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	10					
Charter Boat						
Motorbike						
Person						
PWC						
Recreational Boat	5	1				2
Rock Lobster Boat		1				
Rock Lobster Pots						22
Rock Lobster Tender boat						
Vehicle	21	1	1			2
Vehicle w boat Trailer	1					
Wildlife						
Grand Total	**37**	**3**	**1**			**26**

Section 27	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat	1					
Motorbike						
Person						
PWC						
Recreational Boat	1			1		
Rock Lobster Boat	1					1
Rock Lobster Pots	32	35				
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife			7	3		
Grand Total	**35**	**35**	**7**	**4**		**1**

Section 28	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	19					
Charter Boat						
Motorbike						
Person	2					1
PWC						
Recreational Boat						
Rock Lobster Boat		3				3
Rock Lobster Pots	13	5				62
Rock Lobster Tender boat						
Vehicle	49		3	1	3	6
Vehicle w boat Trailer						
Wildlife						
Grand Total	**83**	**8**	**3**	**1**	**3**	**72**

Section 29	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite						
Charter Boat	1					
Motorbike						
Person						
PWC						
Recreational Boat	4		2			
Rock Lobster Boat	4	2				
Rock Lobster Pots	25	18				5
Rock Lobster Tender boat						
Vehicle						
Vehicle w boat Trailer						
Wildlife			8			
Grand Total	**34**	**20**	**10**	**0**	**0**	**5**

Section 30	11/04/2004	19/06/2004	24/07/2004	4/09/2004	9/10/2004	20/11/2004
Campsite	8					
Charter Boat						
Motorbike	6	11	3		3	9
Person	3		1		1	8
PWC						6
Recreational Boat	6	4		1		1
Rock Lobster Boat		1				4
Rock Lobster Pots	7					71
Rock Lobster Tender boat	6					
Vehicle	55	2	4	5	2	28
Vehicle w boat Trailer	26	6		2		2
Wildlife						
Grand Total	**117**	**24**	**8**	**8**	**6**	**129**

Appendix 2 All day observation survey data

Table 11 Summary of time and number of boat launches and returns

	GREEN HEAD		JURIEN BAY		CERVANTES		
Time	**Boat launches**	**Boat return**	**Boat launches**	**Boat return**	**Boat launches**	**Boat returns**	**Number of boats on the water**
5:00 - 5:15			1	0	2	0	3
5:15 - 5:30			1	0	2	0	6
5:30 - 5:45	1	0	2	0	2	0	11
5:45 - 6:00	1	0	5	2	3	0	18
6:00 - 6:15	5	0	5	0	1	0	29
6:15 - 6:30	1	0	4	0	10	0	44
6:30 - 6:45	1	0	6	0	3	0	54
6:45 - 7:00	2	0	2	0	8	0	66
7:00 - 7:15	2	0	10	0	4	0	82
7:15 - 7:30	6	0	9	1	12	1	107
7:30 - 7:45	1	0	5	1	4	1	115
7:45 - 8:00	1	0	5	1	0	4	116
8:00 - 8:15	2	1	13	0	10	1	139
8:15 - 8:30	4	0	7	2	3	1	150
8:30 - 8:45	1	0	3	1	1	1	153
8:45 - 9:00	1	0	9	2	1	1	161
9:00 - 9:15	4	0	5	1	0	1	168
9:15 - 9:30	1	0	5	0	2	1	175
9:30 - 9:45	1	1	3	1	2	0	179
9:45 - 10:00	0	2	2	0	9	1	187
10:00 - 10:15	0	0	3	2	3	1	190
10:15 - 10:30	1	0	2	3	1	0	191
10:30 - 10:45	1	2	3	2	1	0	192
10:45 - 11:00	0	2	2	2	1	2	189
11:00 - 11:15	0	2	0	5	1	1	182
11:15 - 11:30	0	3	6	4	0	2	179
11:30 - 11:45	0	1	0	6	2	5	169
11:45 - 12:00	1	1	0	2	1	2	166
12:00 - 12:15	0	0	0	2			164
12:15 - 12:30	0	2	1	4	1	3	157
12:30 - 12:45	0	3	1	8	0	5	142
12:45 - 13:00	0	1	0	7	2	3	133
13:00 - 13:15	0	1	0	5	0	4	123
13:15 - 13:30	0	2	0	5	0	1	115
13:30 - 13:45			0	6	0	3	106
13:45 - 14:00			0	3	0	3	100
14:00 - 14:15*	0	1	1	0	0	1	99
14:15 - 14:30			1	2	0	1	97
14:30 - 14:45			0	2	1	1	95
14:45 - 15:00			0	3	0	2	90
15:00 - 15:15			1	2	0	2	87
15:15 - 15:30			1	0	0	1	87
15:30 - 15:45			0	4	0	1	82
15:45 - 16:00*			1	2	0	4	77
16:00 - 16:15*					0	2	75
TOTAL	**38**	**25**	**125**	**93**	**93**	**63**	

Site name	Greenhead boat ramp (north)
GPS location	
Date	4/11/2004
Time arrived	5.30 AM
Time departed	2.15 PM
Total time	8hrs 45mins

Time	Boat launches	Number of people	Boat return & activity	Wind	Water	Cloud Cover %	Other activities
5:00 - 5:15							
5:15 - 5:30							
5:30 - 5:45	1 RB	0	0	1	1	1	
5:45 - 6:00	1 RB	0	0	1	1	1	
6:00 - 6:15	1 RB; 4	8	0	1	1	2	1 person fishing on jetty
6:15 - 6:30	1	3	0	1	1	2	2 people fishing on jetty
6:30 - 6:45	1	3	0	2	2	2	
6:45 - 7:00	2	9	0	2	2	2	3 people walking on jetty
7:00 - 7:15	2	6	0	2	2	2	2 leave jetty, 1 fisherman left
7:15 - 7:30	6	14	0	2	2	2	1 boat 3 fisherman launch off beach not jetty
7:30 - 7:45	1	2	0	3	2	2	2 fisherman on jetty leave, 1 person walking on jetty,2 people walking dogs
7:45 - 8:00	1	3	0	3	2	2	boat return on beach not jetty, 1 walking on jetty(fishing)
8:00 - 8:15	2	7	1 RP	3	2	3	1 walking on jetty
8:15 - 8:30	1 CB;3	14	0	3	2	2	1 boat launched off beach(2 people), 1 boy fishing
8:30 - 8:45	1	4	0	3	2	1	
8:45 - 9:00	1	6	0	3	2	1	
9:00 - 9:15	4	12	0	3	2	1	
9:15 - 9:30	1	4	0	3	2	1	1 kayak south of jetty
9:30 - 9:45	1	4	1-RF	3	2	1	
9:45 - 10:00	0	0	1-RL 1 RB	3	2	1	6 undersize put them back
10:00 - 10:15	0	0	0	3	2	1	2 fishing south of jetty
10:15 - 10:30	1	7	0	3	2	1	
10:30 - 10:45	1	3	1-RL 1 RB	3	2	1	
10:45 - 11:00	0	0	1-RF 1-didn't do survey	3	2	1	
11:00 - 11:15	0	0	2-RF	3	2	1	
11:15 - 11:30	0	0	1-RF 1-RF 1-RL	3	3	1	dhufishing
11:30 - 11:45	0	0	1-CB	3	3	1	pod of 5 dolphins feeding
11:45 - 12:00	1	5	1-swimming/snorkelling/diving	3	3	1	
12:00 - 12:15	0	0	0	3	3	1	
12:15 - 12:30	0	0	1 1-RF	3	3	1	
12:30 - 12:45	0	0	1-boat 1-dingy 1-RF	3	3	1	1 B occupants swimming with ASL
12:45 - 13:00	0	0	1-RF	3	3	1	
13:00 - 13:15	0	0	1-RF	3	3	1	

Time	Boat launches	Number of people	Boat return & activity	Wind	Water	Cloud Cover %	Other activities
13:15 - 13:30	0	0	2-RF	3	3	1	
13:30 - 13:45	0	0					
13:45 - 14:00	0	0					
14:00 - 14:15	0	0	1-RF	3	3	1	
14:15 - 14:30							
14:30 - 14:45							
14:45 - 15:00							
15:00 - 15:15							
15:15 - 15:30							
15:30 - 15:45							
15:45 - 16:00							
16:00 - 16:15							
16:15 - 16:30							
16:30 - 16:45							
16:45 - 17:00							

Site name	Jurien Harbor Boat Ramp
GPS location	
Date	4/11/2004
Time arrived	5:00AM
Time departed	4:00PM
Total time	11hrs

Time	Boat launches	Number of people	Boat return & activity	Wind	Water	Cloud Cover %	Other activities
5:00 - 5:15	1	2	0	1	1	2	
5:15 - 5:30	1	3	0	1	1	2	
5:30 - 5:45	2	6	0	1	1	2	both commercial crayfishermen
5:45 - 6:00	5	14	1-fishing 1-diving	1	1	2	
6:00 - 6:15	5	13	0	1	1	2	commercial crayfishermen 1boat/3people
6:15 - 6:30	4	10	0	1	1	2	
6:30 - 6:45	6	16	0	2	1	2	
6:45 - 7:00	2	5	0	1	1	2	
7:00 - 7:15	10	27	0	1	1	2	
7:15 - 7:30	9	23	1 craypot	1	1	2	1 commercial crayboat
7:30 - 7:45	5	16	1 craypot	1	1	2	
7:45 - 8:00	5	15	1 craypot	1	1	2	
8:00 - 8:15	13	45	0	2	2	1	
8:15 - 8:30	7	21	2 craypots	2	2	1	
8:30 - 8:45	3	6	1 craypot	2	2	1	
8:45 - 9:00	9	26	2 craypots	2	2	1	
9:00 - 9:15	5	19	1 craypot	2	2	1	
9:15 - 9:30	5	23	0	2	2	1	
9:30 - 9:45	3	10	1-sight seeing	2	2	1	
9:45 - 10:00	2	6	0	2	2	2	
10:00 - 10:15	3	6	2-fishing	2	2	2	
10:15 - 10:30	2	7	3-fishing	2	2	2	
10:30 - 10:45	3	8	1-fishing 1-diving	3	2	1	
10:45 - 11:00	2	7	1-surfing, 1-fishing	3	2	1	
11:00 - 11:15	0	0	1-sightseeing on island, 3-fishing, 1-swim	3	2	1	
11:15 - 11:30	6	24	3-fishing, 1-diving	3	2	1	
11:30 - 11:45	0	0	6-fishing	3	2	1	
11:45 - 12:00	0	0	1-sightseeing on island, 1-waterskiing	3	2	1	
12:00 - 12:15	0	0	2-fishing	3	2	1	
12:15 - 12:30	1	4	4-fishing	3	2	1	
12:30 - 12:45	1	5	7-fishing, 1-SCUBA	3	2	1	return crayboat to pen
12:45 - 13:00	0	0	7-fishing	3	2	1	
13:00 - 13:15	0	0	4-fishing, 1-SCUBA	3	2	1	
13:15 - 13:30	0	0	4-fishing, 1-SCUBA	3	2	1	
13:30 - 13:45	0	0	5-fishing, 1-SCUBA	3	2	1	
13:45 - 14:00	0	0	3-fishing	3	2	1	
14:00 - 14:15	1	5	0	3	2	1	
14:15 - 14:30	1	3	2-fishing	3	2	1	
14:30 - 14:45	0	0	2-fishing	3	2	1	
14:45 - 15:00	0	0	3-fishing	3	2	1	
15:00 - 15:15	1	6	1-fishing 1-diving	3	2	1	
15:15 - 15:30	1	2	0	3	2	1	
15:30 - 15:45	0	0	2-fishing, 2-spearfishing	3	2	1	

Time	Boat launches	Number of people	Boat return & activity	Wind	Water	Cloud Cover %	Other activities
15:45 - 16:00	1	4	2-fishing	3	2	1	
16:00 - 16:15							
16:15 - 16:30							
16:30 - 16:45							
16:45 - 17:00							

Site name	Cervantes beach boat launching area
GPS location	
Date	4/10/2004
Time arrived	5:05 AM
Time departed	4:30PM
Total time	11hrs 25 mins

Time	Boat launches	Number of people	Boat return & activity	Wind	Water	Cloud Cover %	Other activities
5:00 - 5:15	2		0	1	1	4	dingy(tend to crayboat), cabin (2)
5:15 - 5:30	2		0	1	1	4	2 dingys(tend to crayboats)
5:30 - 5:45	2		0	1	1	4	2 dingys(tend to crayboats)
5:45 - 6:00	3		0	1	1	4	2 dingys(tend to crayboats), cabin (2)
6:00 - 6:15	1		0	1	1	2	runabout
6:15 - 6:30	10		0				runabout 4 (2 walkers) cabin (5) dingy(1)
6:30 - 6:45	3		0				1 walker, 4 beach fishers
6:45 - 7:00	8		0				4 walkers
7:00 - 7:15	4		0				husband+wife
7:15 - 7:30	12		1-fishing				3 walking, 1 walker with dog
7:30 - 7:45	4		1-fishing	2	2	1	3 walkers
7:45 - 8:00	0		4-boats fishing	2	2	1	
8:00 - 8:15	10		1-fishing	2	2	2	2 walking, 1 walker with dog
8:15 - 8:30	3		1-fishing	2	2	2	
8:30 - 8:45	1		1-fishing	2	1	1	2 kayakers, 2 walkers
8:45 - 9:00	1		1-fishing	2	1	1	3 walkers
9:00 - 9:15	0		1-fishing	2	1	1	6 walkers
9:15 - 9:30	2		1-fishing	2	1	1	7 walkers
9:30 - 9:45	2		0	2	1	1	2 walkers, 3 beach goers
9:45 - 10:00	9		1-fishing boat return	2	1	1	5 walkers
10:00 - 10:15	3		1-fishing	1	2	1	8 walkers
10:15 - 10:30	1		0	1	2	1	5 walkers(2 groups),4 playing footy, 1 walker with dog
10:30 - 10:45	1		0	1	2	1	
10:45 - 11:00	1		crayboats start returning	1	2	1	2 walkers with dog
11:00 - 11:15	1		1-not interviewed other end of beach	1	2	1	2 walkers
11:15 - 11:30	0		2-not interviewed other end of beach	1	2	1	2 kayakers
11:30 - 11:45	2		2-fishing 3-boats	1	2	1	
11:45 - 12:00	1		1-not interviewed 1-dingy	1	2	1	2 walkers, 3 beach goers, 1 walker with dog
12:00 - 12:15	LUNCH						
12:15 - 12:30	1		3-boats(1 interviewed)	3	3	1	
12:30 - 12:45	0		2-boats fishing 3-not interviewed	3	3	1	
12:45 - 13:00	2		2-boats fishing 1-not interviewed	3	3	1	aust pacific tour bus drive along beach(20 people)
13:00 - 13:15	0		1-prof crayboat 3-fishing	3	3	1	2 walkers fed sealion @ south island(100m offshore) on way back
13:15 - 13:30	0		1-fishing	3	3	1	6 swimming, 3 beach goers, 2 walkers

Time	Boat launches	Number of people	Boat return & activity	Wind	Water	Cloud Cover %	Other activities
13:30 - 13:45	0		3-boats fishing	3	3	1	
13:45 - 14:00	0		1-fishing 2-fishing+diving	3	3	1	1 vehicle, 3 walkers, 5 playing cricket
14:00 - 14:15	0		1-fishing	2	1	1	2 4WD 2 people
14:15 - 14:30	0		1-fishing	2	1	1	1 4WD 1 person, 2 walkers
14:30 - 14:45	1		1-fishing+diving	2	1	1	1 4WD 5 people
14:45 - 15:00	0		1-fishing 1-fishing+diving	3	3	1	2 people with dog,1 car,1 4WD wind surfer, 2 people
15:00 - 15:15	0		2-boats fishing	3	2	1	1 2WD
15:15 - 15:30	0		1-fishing+diving	3	2	1	10 people, 1 car 2 people
15:30 - 15:45	0		1-fishing	2	2	1	1 car, 2 4WD
15:45 - 16:00	0		4-boats fishing	2	2	1	1 car, 1 4WD
16:00 - 16:15	0		2-boats fishing	2	2	1	1 4WD, 4 trailers left
16:15 - 16:30							
16:30 - 16:45							
16:45 - 17:00							

Appendix 3 Questionnaire raw data