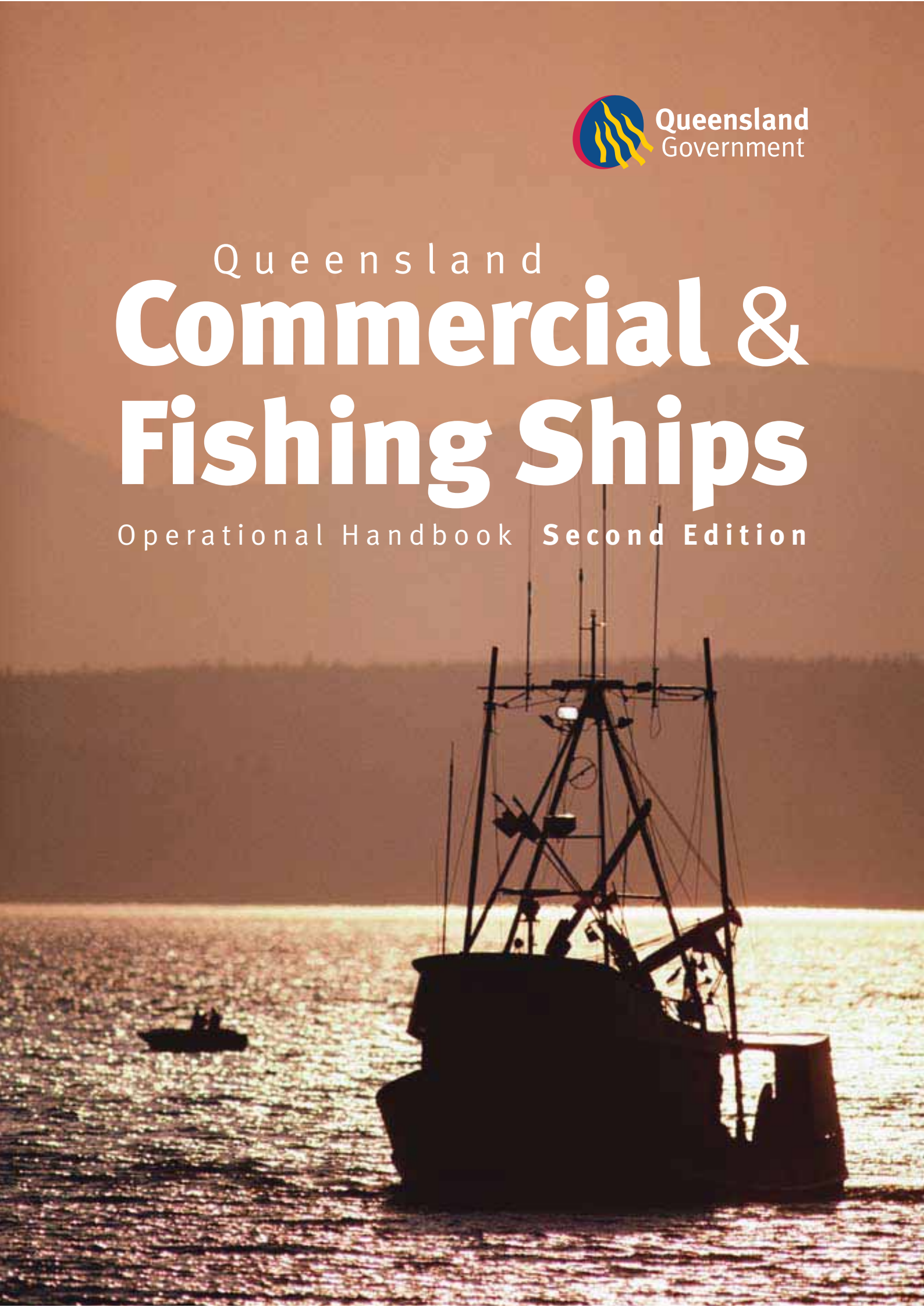
Queensland Government

Queensland

Commercial & Fishing Ships

Operational Handbook **Second Edition**



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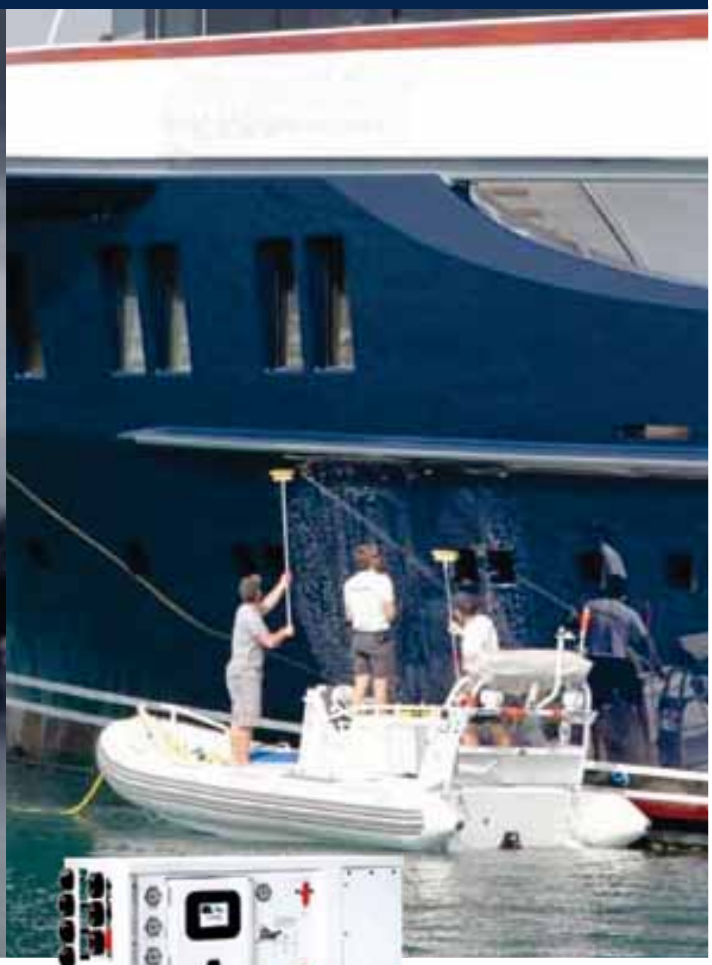

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Purpose and limitations

The notes and commentaries contained within this publication are only a summary of the Acts and Regulations and are an information source only, being intended to familiarise you with the main points of the legislation and to guide you on the current regulations that apply to commercial vessels in Queensland. They are not a precise statement of the law, as the Acts which cover commercial vessels in Queensland are subject to change from time to time.

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Contacts

Australian maritime authorities

Australian Maritime Safety Authority

1800 641 792 www.amsa.gov.au

Queensland Maritime Safety Queensland	07) 3120 7462 www.msq.qld.gov.au	**South Australia** SA Transport	08) 8343 2222 www.transport.sa.gov.au
New South Wales Waterways Authority	02) 9563 8557 www.maritime.nsw.gov.au	**Western Australia** WA Transport	08) 9216 8000 www.transport.wa.gov.au
Victoria Marine Safety Victoria	03) 9655 3399 www.marinesafety.vic.gov.au	**Northern Territory** Department of Transport and Works	08) 8924 7100 www.nt.gov.au

Other useful Australian websites contacts

Bureau of Meteorology	www.bom.gov.au
Australian Hydrographic Service	www.hydro.gov.au
Australian Communications and Media Authority	www.acma.gov.au
Australian Customs and Border Protection Service	www.customs.gov.au
Australian Quarantine and Inspection Service	www.daff.gov.au/aqis
Department of Immigration and Citizenship	www.immi.gov.au
Australian Federal Police	www.afp.gov.au
National Marine Safety Committee	www.nmsc.gov.au

Queensland

Maritime Safety Queensland

(A/h numbers are **only** for reporting of marine incidents and marine pollution)

Gold Coast
40-44 Seaworld Drive Main Beach 4215
Phone: 07) 5539 7300 A/h: 07) 5539 7373

Brisbane
MacArthur Avenue East Pinkenba 4008
Phone: 07) 3860 3500 A/h: 07) 5539 7373

Mooloolaba
Old Pilot Station Parkyn Parade Mooloolaba 4557
Phone: 07) 5477 8425 Ah: 07) 3305 1700

Hervey Bay
Buccaneer Avenue Hervey Bay 4008
Phone: 07) 4194 9600 A/h: 07) 4973 1208

Bundaberg
2nd Floor 46 Quay Street Bundaberg 4670
Phone: 07) 4131 8500 Ah: 07) 4973 1208

Gladstone
Level 2 Centrepoint Building 136 Goodoon Street
Gladstone 4680
Phone: 07) 4973 1200 A/h: 07) 4973 1208

Mackay
14 Discovery Lane Mt Pleasant 4740
Phone: 07) 49443700 A/h: 07) 4956 3489

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384 Shute Harbour Road Airlie Beach 4802
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Townsville
60 Ross Street South Townsville 4810
Phone: 07) 4726 3400 A/h: 07) 0419 553 313

Cairns
64-66 Tingira Street Portsmith 4870
Phone: 07) 4052 7400
Ah: 07) 4052 7470 or 1300 551 899

Thursday Island
Hastings Street Thursday Island 4875
Phone: 07) 4069 1351
Ah: 07) 4052 7470 or 1300 551 899

Weipa
1 Iraci Avenue Weipa 4874
Phone: 07) 4069 7165
Ah: 07) 4052 7470 or 1300 551 899

Karumba
Lot 75 Yappar Street Karumba 4891
Phone: 07) 4745 9281
Ah: 07) 4052 7470 or 1300 551 899

Contacts

Queensland — authorised registered training organisations (RTO)

The list of Maritime Safety Queensland's authorised RTOs is available on the website www.msq.qld.gov.au. Contact a registered training organisation in your area for information and details about the competency based training (CBT) they provide.

Prior to enrolling in any course, you should have your sea service assessed, and had your medical fitness and eyesight standards examined.

Under the *Mutual Recognition (Queensland) Act 1992*, Maritime Safety Queensland recognises training and assessment conducted by other Australian state or territory registered training organisations provided that the registered training organisation is authorised to conduct such training and assessment by their respective Australian state or territory maritime authority.

Other useful Queensland contacts

Queensland Water Police

Gold Coast	07) 5509 5700	Yeppoon	07) 4933 7990
Wynnum	07) 3829 4129	Whitsunday	07) 4967 7222
Brisbane	07) 3895 0333	Townsville	07) 4760 7812
Sunshine Coast	07) 5413 8788	Cairns	07) 4057 3577
Hervey Bay	07) 4125 3900	Thursday Island	07) 4069 1520
Gladstone	07) 4971 2561		

Queensland Boating and Fisheries Patrol

Coastal

Gold Coast	07) 5583 5500	Townsville	07) 4722 7311
Redland Bay	07) 3824 9545	Ingham	07) 4776 1611
Brisbane	07) 3860 3502	Cairns	07) 4035 0700
Mooloolaba	07) 5444 4599	Port Douglas	07) 4099 5160
Noosa	07) 5449 7555	Thursday Island	07) 4069 1772
Hervey Bay	07) 4125 3989	Weipa	07) 4069 8114
Bundaberg	07) 4131 5817	Karumba	07) 4745 9142
Gladstone	07) 4972 0699		
Yeppoon	07) 4933 6404	**Inland**	
Mackay	07) 4967 0724	Roma	07) 4622 9999
Airlie Beach	07) 4946 7003	Wondai	07) 4168 5990
Bowen	07) 4786 3444	Longreach	07) 4650 1200

Queensland Parks and Wildlife Service	1300 130 372	www.derm.qld.gov.au
Great Barrier Reef Marine Park Authority	1800 990 177	www.gbrmpa.gov.au

Introduction

A career in the commercial maritime industry in Australia is one that can lead you down many exciting pathways. Commercial vessels that are used in Australian waters include fishing and tourism vessels, passenger ferries, exploration and expedition vessels, trading ships (both domestic and foreign-going), barges, dredges and tugs. Also, there is an increasing reliance on commercially-qualified masters, engineers and crew members for larger private vessels. All these options ensure a tremendous opportunity for a rewarding and challenging career, in which the scope of growth and availability of training has enabled many a deckhand to progress along their career path to become the master of a foreign-going ship.

In Australia, industries in the resource and tourism sectors are experiencing significant growth and as a result the demand for qualified crew members is growing. Increased regulation in the fishing industry, which will ensure its future rather than inhibit it, requires a professional and progressive approach from crew members and masters of fishing ships in order to meet the challenges of sustainability.

However, even to the experienced recreational boater, entry into the commercial sector can seem daunting. Certification, survey requirements, domestic and international regulations and the need to become familiar with a whole new nautical language may seem like challenging obstacles to overcome.

Common to all aspects of commercial seafaring, regardless of the nature of the vessel, is the requirement that crews are competent mariners and have a broad knowledge of practices that are specific to seafaring in all its forms throughout the world. Some of these skills are hundreds of years old, others are skills that are essential to our modern day occupational health and safety requirements or specific to machinery and equipment commonly used on today's vessels.

What this manual covers

This manual is a learning aid for crew members new to working on a commercial vessel and includes information on:

- Legislation, conventions and regulations under which all commercial vessels operate.
- The requirements for certification and the crewing of commercial vessels in Queensland.
- How to assist the master and fellow crew members to deal with any onboard emergencies that may arise.
- Using terminology common to all ships.
- Understanding your obligations with regard to safe working practices.
- Identifying and comprehending the basic elements of good seamanship and safe navigation.

CHAPTER 1

Regulations and your obligations

What is a commercial vessel?

All ships used for activities that are undertaken for financial reward are commercial vessels, even if no fees are received directly by the vessel (such as vessels used at resorts). Any vessel used for a commercial venture must be registered accordingly and operated by commercially-qualified masters, engineers and crew.

Commercial vessels are required by law to comply with certain standards of construction, equipment and manning. Generally, commercial vessels are purpose built from scratch according to their intended purpose and area of operation.

Class of registration

When a vessel is inspected, a certificate of compliance will be issued and it will be given a registration class by the registering authority. In Queensland, there are four classes of ship that are further broken down into 15 possible categories of operational area. In Australia a simple system of numerals and letters is used.

The number indicates the type of ship:

Class 1 Passenger ships
Class 2 Non-passengerships
Class 3 Fishing ships
Class 4 Commercial hire ships.

The letter indicates their area of operation:

A Unlimited (foreign-going)
B Offshore
C Restricted offshore
D Partially smooth waters
E Smooth waters.

SHIP TYPE	Unlimited	Offshore	Restricted offshore	Partially smooth and smooth	Smooth
Passenger	1A	1B	1C	1D	1E
Non-passenger	2A	2B	2C	2D	2E
Fishing	3A	3B	3C	3D	3E
Commercial Hire	n/a	n/a	4C	4D	4E

Ship registration and procedures

Commercial vessels must be registered with Maritime Safety Queensland when in use on Queensland waters. The following ships must be commercially registered:

- Ships operating in Queensland waters that are owned or chartered by a person whose principal place of residence is in Queensland.
- Ships operated by a person whose place of or principal place of business is in Queensland.
- Ships operated by a person whose principal place of business for managing the ship's operations is in Queensland.

However, this does not apply to:

- A ship that must be and is registered under the *Commonwealth Shipping Registration Act 1981*. Ships registered under the Commonwealth Act also require a current certificate of survey under Commonwealth law to be exempt from state registration.
- A commercial ship (other than a barge) that is unpowered, or if powered, is powered by an engine of less than 3 kilowatts (kW).

- Fishing ships less than 10 metres (m) in length.
- A tender to a registered commercial ship if the tender operates within two nautical miles of the mother ship. Before its use, the owner of the ship must record details of the tender in an equipment list or log book kept for the mother ship.
- A ship displaying a Restricted Use Flag.
- Commercial barges less than 15 m (unpowered or powered by an engine of less than 3 kW) not being used for carrying passengers, bulk petroleum or gas products, living aboard or entertainment, operating a pile frame, crane with safe working load over three tonnes or dredging machinery having a total brake power of 500 kW or more.

Ships that are not on or in the water do not have to be registered. For example if registration expires while the ship is on the slip being repaired, it only needs registering before being put back in the water. All ships moored and in the water must be registered, even if they are not in use for long periods of time. Registration must not lapse.

All ships of more than 15 m in length are required to have insurance sufficient to pay for potential pollution clean up, salvage and wreck removal.

After a ship is registered, the registration number must be displayed permanently and be visible from at least 30 metres. Some vessels over 24 metres in length, particularly cargo vessels, may require a loadline certificate which determines how much weight the vessel is allowed to carry.

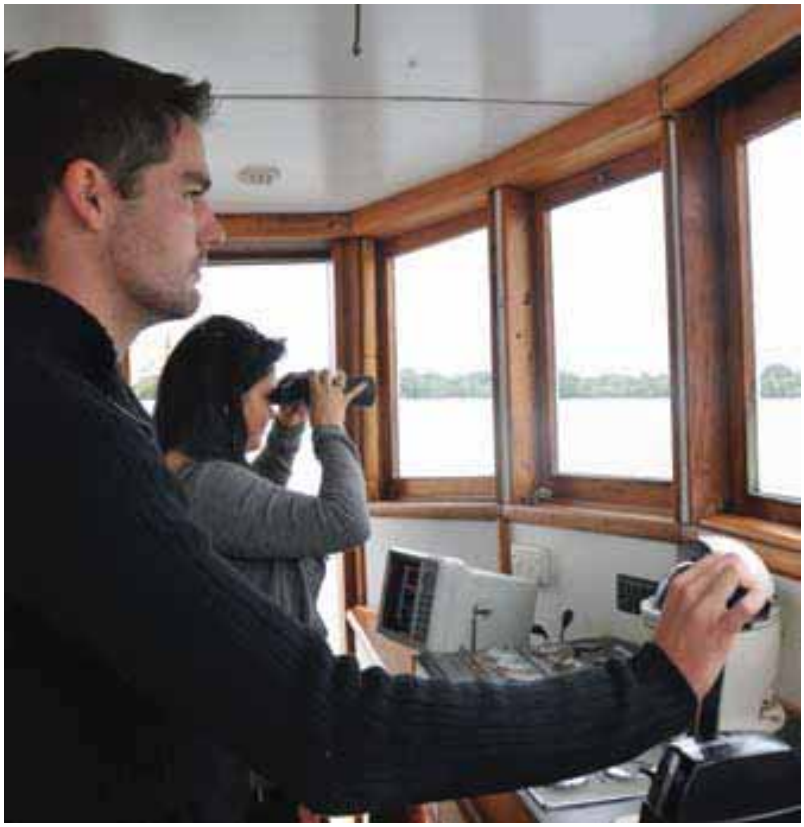
Safety management system

Commercial vessels in Queensland are required to carry onboard and maintain various manuals and plans. One of the required documents is a safety management system (SMS), which is a collection of all the documents that can be used by a vessel owner to show that their vessel is complying with safe operating procedures, records and risk management practices.

All crew members must be able to access and understand the documents. The issues it addresses may include, but not be limited to, the following:

- company details
- crew particulars
- job descriptions
- copies of licences and permits
- safety inductions for crew.

Commercial licensing



The skills required by crew members onboard a commercial vessel are complex. For example, crew members need to operate machinery safely, navigate and manoeuvre the ship, plan a voyage, understand legislation and regulations and deal with any emergency that may arise in a stressful environment. Crew members only have their training, experience and resources available on the ship to rectify an emergency so the vessel can return safely to shore.

To hold a commercial qualification as a master or engineer one needs to be an administrator, a navigator, a mariner, a good communicator, and a leader of people. The master and engineer need proven experience at sea, not just classroom knowledge.

Training, certification and commercial licensing

Maritime Safety Queensland is the marine safety regulator and licence-issuing authority in Queensland and is committed to enhancing the quality of a prospective licence candidate's learning experience and the quality of the marine training program.

With this objective in mind, Maritime Safety Queensland fully supports the national initiative to introduce competency-based training and assessment that focuses on learning and obtaining practical core skills and knowledge in the workplace. Students complete a combination of on-the-job workplace-based task books and a range of assignments and assessments while enrolled with a Maritime Safety Queensland-approved registered training organisation (RTO). Following the successful completion of a workplace competency-based training program a student will receive an Australian Qualification Framework (AQF) nationally-recognised certificate that is acceptable towards a commercial marine licence.

Maritime training is focused on assisting crew to gain quality of sea service rather than quantity. For example workplace-based task books help crew, masters and engineers to support quality skill outcomes and are a true measure of sea service and quality practical experience at sea, not just time spent at sea. The maritime training package is designed to help students learn skills and gain qualifications progressively over their career.

Maritime training in Queensland is offered through a competency-based training delivery framework that incorporates a blend of theory and practical skills. Training is flexible and is designed to meet each student's individual learning needs. RTOs work with the students to develop a suitable training program which could include enrolling in a full certificate, enrolling in a qualification over time by clustering interrelated units or through recognition of prior learning (RPL). The focus of all maritime training is on gaining skills in the workplace and acquiring knowledge through formal learning on the job, supported by the training provider.

A number of RTOs across Queensland and Australia offer maritime training but they offer a range of different delivery strategies including lectures, tutorials,

workshops, one-to-one instruction, multimedia resources, email and phone support and flexible enrolment periods. RTOs also offer a varied range of training and assessment that may include a combination of training delivered onsite in the workplace, at a training facility or on a commercial training vessel. This enables a potential student to source a training program that best suits their individual needs such as location, employment conditions, time, experience and financial arrangements.

Traineeships and industry partnerships are also available at certificate levels 1, 2 and 3. A traineeship involves a contract between the trainee, the trainee's employer, the RTO and the government through a new apprentice centre. School-based traineeships are also available. Information on traineeships can be found through the Department of Education and Training, new apprentice centres, public training providers and school careers centres.

With an AQF certificate from the RTO, the candidate can then apply for a commercial marine licence. This involves submitting sea time to a Maritime Safety Queensland regional office, completing an application for an independent assessment and providing such prerequisites as an eye sight and medical certificate, radio licence and a current first aid certificate.

Steps to obtain a commercial licence

1. Check the current requirements and prerequisites for the relevant licence level at a Maritime Safety Queensland regional office or on the Maritime Safety Queensland website (www.msq.qld.gov.au).
2. Enrol in a marine training program with an RTO and:
    - contribute to the development of the training plan or program
    - attend lectures and/or tutorials as needed
    - complete written theory assessments
    - submit assignments which are based on vessel operations
    - submit a completed workplace-based task book
    - complete practical assessments with an RTO assessor.
3. At a Maritime Safety Queensland regional office:
    - apply for a sea time assessment
    - apply for an oral assessment
    - present an AQF Certificate in Transport and Distribution (Maritime Operations) or (Coastal Maritime Operations)
    - provide two recent passport photos
    - present, where relevant, a current eyesight test and medical certificate
    - pay appropriate fee
    - successfully complete an oral assessment.

The workplace-based task book

- Qualified supervisors verify tasks by initialling skills they have observed that are performed to an industry standard.
- Record contact details of the supervisor/s and vessel details in the task book.

- Students who cannot complete all tasks on their vessel may, by arrangement, complete them on alternative vessels.
- Signing a task book is not an assessment it is a skills record.
- The RTO signs off all completed task books.

Supervisors (qualified onboard crew)

To initial that a task has been observed in a task book the workplace supervisor must:

- Hold a licence equal to or above the qualification being supervised and/or a person who holds a trade certificate. For example, a marine mechanic supervising coxswain engineering tasks.
- Sign off observed tasks that are consistently completed to a satisfactory level.
- Workplace-based task books and supervisor observations are verified as authentic by Maritime Safety Queensland officers and RTO assessors.

The following tables outline qualifications based on vessel length, engine power and operating area.

Deck licences — trading/commercial ships				
	Ship length			
Operational area	**Less than 12 metres**	**Less than 24 metres**	**Less than 35 metres**	**Less than 80 metres**
Operations within 600 nautical miles of the mainland coast (Australian Coastal and Middle Water operations)	Master Class 4	Master Class 4	Master Class 4	Master Class 3
Operations within 200 nautical miles of the mainland coast (offshore operations)	Master Class 5	Master Class 5	Master Class 4	Master Class 3
Operations within 50 nautical miles or within the Great Barrier Reef Region and/or Torres Strait Zone	Master Class 5	Master Class 5	Master Class 4	Master Class 4*
Operations within 15 nautical miles seaward of the mainland coast (inshore operations) or within 15 nautical miles seaward of the boundaries of the designated smooth and partially smooth water limits (sheltered waters)	Coxswain	Master Class 5	Master Class 4	Master Class 4
Operations within smooth and partially smooth water limits (sheltered waters)	Coxswain restricted	Master Class 5 restricted	Master Class 4 restricted	Master Class 4 restricted

*Indicates exemptions are provided in the *Transport Operations (Marine Safety) Regulation 2004*.
*Restrictions may vary from state to state. Contact your local marine authority for details.

Deck licences — fishing ships				
	Ship length			
Operational area	**Less than 15 metres**	**Less than 24 metres**	**Less than 35 metres**	**Less than 80 metres**
Operations within 600 nautical miles of the mainland coast (Australian Coastal and middle water operations)	Skipper Grade 2	Skipper Grade 2	Skipper Grade 2	Skipper Grade 1
Operations within 200 nautical miles of the mainland coast (offshore operations)	Skipper Grade 3	Skipper Grade 3*	Skipper Grade 2	Skipper Grade 2
Operations within the fishing ship operational area (schedule 11 of the *Transport Operations (Marine Safety) Regulation 2004)*	Coxswain*	Skipper Grade 3*	Skipper Grade 2	Skipper Grade 2
Operations within 15 nautical miles seaward of the mainland coast (inshore operations) or within 15 nautical miles seaward of the boundaries of the designated smooth and partially smooth water limits (sheltered waters)	Coxswain	Skipper Grade 3	Skipper Grade 2	Skipper Grade 2
Operations within smooth and partially smooth water limits (sheltered waters)	Coxswain restricted	Skipper Grade 3	Skipper Grade 2	Skipper Grade 2

*Indicates exemptions are provided in the *Transport Operations (Marine Safety) Regulation 2004*.
*Restrictions may vary from state to state. Contact your local marine authority for details.

Engineering licences — trading/commercial ships					
	Propulsion power kilowatt rating**				
Operational area	**Up to 250 kW *****	**Up to 500 kW *****	**Up to 750 kW *****	**Up to 1500 kW**	**1500 kW and over**
Operations within 600 nautical miles of the mainland coast (Australian Coastal and middle water operations)	MED Grade 2	MED Grade 1	MED Grade 1	Engineer Class 3	Determined by the authority
Operations within 200 nautical miles of the mainland coast (offshore operations)	MED Grade 2	MED Grade 2	MED Grade 1	Engineer Class 3	Engineer Class 2 (Refer to AMSA)
Operations within 100 nautical miles of the mainland coast	MED Grade 3	MED Grade 2	MED Grade 1	Engineer Class 3	Engineer Class 2 (Refer to AMSA)
Operations within the Great Barrier Reef Region and/or Torres Strait Zone	MED Grade 2 (for beyond offshore (100 nm), otherwise MED Grade 3)	MED Grade 2	MED Grade 1	MED Grade 1* (ships 750kW — 1500kW)	Engineer Class 3 (ships 1500kW — 3000kW)
Operations within 30 nautical miles of the mainland coast (Restricted offshore operations)	MED Grade 3	MED Grade 2	MED Grade 1	MED Grade 1	Engineer Class 2 (Refer to AMSA)
Operations within 15 nautical miles seaward of the mainland coast (inshore operations) or within 15 nautical miles seaward of the boundaries of the designated smooth and partially smooth water limits (sheltered waters)	MED Grade 3/ Coxswain (ships less than 12 metres)	MED Grade 3	MED Grade 2	MED Grade 1	Engineer Class 2 (Refer to AMSA)
Operations within smooth and partially smooth water limits (sheltered waters)	MED Grade 3/ Coxswain (ships less than 12 metres)	MED Grade 3	MED Grade 2	MED Grade 1	Engineer Class 2 (Refer to AMSA)

*Indicates exemptions are provided in the *Transport Operations (Marine Safety) Regulation 2004*.

**Under Queensland legislation, propulsion power of a vessel is defined as the maximum continuous rated power in kilowatts of the largest propulsion engine on the vessel.

***A master of a training/commercial or fishing ship with a propulsion power of less than 750kW may act as both master and engineer if the master also holds an appropriate certificate to act as engineer of the vessel.

Engineering licences — fishing ships						
	Propulsion power kilowatt rating**					
Operational area	**Up to 250 kW *** **	**Up to 300 kW*****	**Up to 500 kW*****	**Up to 750kW*****	**Up to 1500 kW**	**Up to 1500 kW and over**
Operations within 600 nautical miles of the mainland coast (Australian Coastal and middle water operations)	MED Grade 2	MED Grade 1	MED Grade 1	MED Grade 1	Engineer Class 3	Engineer Class 3* (also refer note ****)
Operations within 200 nautical miles of the mainland coast (offshore operations)	MED Grade 3	MED Grade 3*	MED Grade 2	MED Grade 1	Engineer Class 3	Engineer Class 3* (also refer note ****)
Operations within the fishing ship operational area (schedule 11 of the *Transport Operations (Marine Safety) Regulation 2004*)	MED Grade 3	MED Grade 3*	MED Grade 1	MED Grade 1	MED Grade 1* (ships 750kW — 1500kW)	Engineer Class 3* (also refer note ****)
Operations within 50 nautical miles of the mainland coast	MED Grade 3	MED Grade 3	MED Grade 2	MED Grade 1	MED Grade 1* (ships 750kW — 1500kW)	Engineer Class 3* (also refer note ****)
Operations within 15 nautical miles seaward of the mainland coast (inshore operations) or within 15 nautical miles seaward of the boundaries of the designated smooth and partially smooth water limits (sheltered waters)	Coxswain	MED Grade 3	MED Grade 3	MED Grade 2	MED Grade 1	Engineer Class 3* (also refer note ****)
Operations within smooth and partially smooth water limits (sheltered waters)	Coxswain	MED Grade 3	MED Grade 3	MED Grade 2	MED Grade 1	Engineer Class 3* (also refer note ****)

*Indicates exemptions are provided in the *Transport Operations (Marine Safety) Regulation 2004*.

**Under Queensland legislation, propulsion power of a vessel is defined as the maximum continuous rated power in kilowatts of the largest propulsion engine on the vessel.

***A master of a training/commercial or fishing vessel with a propulsion power of less than 750kW may act as both master and engineer if the master also holds an appropriate certificate to act as engineer of the vessel.

****For ships 3000kW and over, the holder must have completed the course 'Prevention and Control of Shipboard Fires' as per section 2 and 3 of the *Uniform Shipping Laws Code*.

New crew induction

It is a requirement of vessel owners and masters that new crew members complete an Elements of Shipboard Safety (ESS) course within the first six months of joining a vessel. This course provides an overview of the aspects of working in the marine environment. ESS has a strong focus on emergency response training and survival techniques and forms the basis of all future marine training courses.

To provide a structured approach to new crew induction Maritime Safety Queensland has produced the Marine Safe Crew Induction Workbook. The workbook is designed to provide relevant underpinning knowledge enabling new crew to maintain professional standards onboard a vessel.

Copies of the workbook can be obtained from Maritime Safety Queensland regional offices.

The best place for crew, masters and engineers to acquire the skills and knowledge necessary to deal with the realities of commercial vessel operations is onboard a vessel while at sea. The true test of competency is the effective application of essential skills and knowledge in a relevant workplace setting.

What is expected of crew members?

General safety obligation

Ultimately, it is the master's prime responsibility to ensure the safe operation of the ship, however no matter what a crew member's duties are onboard, they also have a legal obligation to make the day-to-day running of the vessel as safe as possible. This is known as the general safety obligation.

A crew member, as a minimum, must:

- be inducted onto the vessel
- know where the safety equipment is and how to use it
- acquire the correct skills to help operate the vessel.

As a fundamental principle of the legislation, the general safety obligation transfers the responsibility for safety to owners and operators and encourages risk management. The Act imposes the general safety obligation on:

- ship builders, designers and surveyors about the condition of ships
- persons involved with the operation of a ship to operate it safely
- owners and masters about safety equipment.

All owners, masters and crew members must ensure the ship is:

- safe
- properly equipped and crewed
- operated in a safe manner.

In short, the general safety obligation prohibits a ship from going to sea if it is not properly built and maintained, equipped, crewed and operated in accordance with its proposed operating environment. Information about the general safety obligation is available on the Maritime Safety Queensland website at www.msq.qld.gov.au, under safety.

If a crew member, master or owner is found in breach of the general safety obligation they may be fined up to $50,000 or imprisoned for one year. If the breach causes death or bodily harm to a person, the penalty could be as high as $500,000 or imprisonment for two years.

Occupational health and safety

All workplaces, including in the maritime industry, are subject to occupational health and safety legislation to prevent or minimise a person's exposure to risk of death, injury or illness caused by a workplace, workplace activities or workplace plant and equipment.

The legislation imposes obligations on employers to ensure:

- the health and safety of themselves and each of the employees in the workplace
- work duties will not affect the health and safety of others.

It imposes obligations on employees to:

- comply with instructions given for workplace health and safety
- use personal protective equipment
- not interfere with or misuse anything provided for workplace health and safety
- not place at risk any person in the workplace
- not wilfully injure themselves.

These obligations represent a duty of care for all parties. This requires that everything reasonable and practicable is done by everybody at all levels to protect their health and safety in the workplace.

Alcohol and drugs

Coordination, judgement, vision, balance and reaction time, when under the influence of alcohol or drugs, can decline up to three times faster on the water compared to on land. The motion of the vessel on the sea, engine noise and the weather on the water help to multiply their negative effects.

In an emergency, chances of survival are drastically reduced if under the influence of alcohol or drugs. In the water, loss of body heat and exhaustion happens faster and swimming ability deteriorates rapidly.

The master and crew members of a commercial vessel are required by law to have a blood alcohol level of zero for class 1 ships and under 0.05% for class 2 and 3 ships. In the State of Queensland any conviction of drink driving on land could result in the cancellation of your marine certificate as well as the loss of your driver license.

Crew members are not permitted to be under the influence of illegal substances. Also, crew members must consider the influence that prescription medications may have. For example, even medications such as hay fever or seasickness tablets can cause drowsiness. You must always check the side effects of medication that you have taken before going on duty.

When working on a commercial vessel, the lives of others depends on the sobriety of crew members. Crew members must be alert and sober.

Fatigue

Fatigue is comparable with the effects of alcohol and drugs in terms of the safety of the ship and the crew. A relieving watchkeeper must have had 10 hours rest in the previous 24, six of which must have been continuous rest. If fatigue is suspected in a crew member, the master must be informed.

It is the responsibility of the watchkeeper being relieved to ensure the oncoming crew member is fit for duty. If the oncoming watchkeeper is not well rested, they won't be as alert as they need to be. This may result in an incident occurring because the master wasn't alerted to a navigational hazard.

Watchkeeping can also be lonely job on a small ship — particularly at night. Many vessels are fitted with a 'deadman's switch' which is a device that sounds an alarm at stated intervals that the watchkeeper must cancel each time. If a watchkeeper feels fatigued, the master must be informed as it is the safety of the ship and all onboard that is at risk.

Fatigue will also affect performance of crew members working on the deck of a ship in a potentially dangerous environment. Deck machinery, slippery surfaces, hot liquids in the galley and the movement of the vessel in a seaway means that all crew members need to be alert at all times.

Pollution

Whether a vessel is large or small, it is an offence to discharge garbage, oil and chemicals into Queensland waters (either deliberately or negligently) and severe penalties apply.

Crew members on a commercial vessel must:

- be vigilant for stray rubbish on deck
- comply with the onboard garbage management plan
- educate passengers and new crew members on the consequences of marine pollution.

Oil and chemicals

Most oil and chemical pollution results from activities such as refuelling, boat maintenance and bilge discharges. Oils, including petrol, hydraulic oil and gear box oil and chemicals, such as degreasers and paints, contain a range of toxins harmful to both marine animals and humans.

Crew onboard commercial vessels need to help reduce oil and chemicals entering our waterways.

- Do not overfill the fuel tank.
- Watch the breathers for signs of blow-back or overflow.
- Ensure the bilges are clean before discharging them.
- Use phosphate-free biodegradable detergents.
- Carry absorbent materials onboard to clean up accidental spills.
- If oil or chemicals are accidentally spilled into the water, or if a spill is observed, contact the local Maritime Safety Queensland regional office, marina manager or port authority so that it can be contained and cleaned up as soon as possible.

What to do in the event of a fuel spill

Scenario: a deckhand is refuelling at the fuel wharf and operating as part of a team. The fuel tank breathers are blocked and about ten litres of diesel blows back and out onto the deck of the ship. The freeing ports in the bulwarks of the ship are not closed and it enters the water. What should be done?

- Contain the spill using the emergency containment kit on the fuel dock.
- Ensure no further spillage is possible from the vessel or the dock.
- Notify the regional harbour master as soon as possible.
- Ensure that no source of ignition is possible — keep fire-fighting appliances on hand.
- Don't use detergents or dispersants on the spill.

Marpol

Marpol is the *International Convention for the Prevention of Pollution from Ships, 1973* as modified by the protocol of 1978. It is an international convention that has been adopted under Australian federal and state law and all commercial mariners are required to comply with its contents in order to prevent pollution incidents while undertaking routine operations on a vessel.

Garbage

Everyday items such as cigarette butts, plastic bags, bottles, cans, discarded fishing line and other fishing gear are common causes of marine pollution. These objects, whether discarded intentionally or simply blown overboard, contribute to increasing pressures on marine ecosystems. Marine animals and sea birds can mistake plastic material for food and, as a result, often end up dying of starvation or strangulation.

Simple measures can help protect marine life and save on the cost of a fine.

- Don't throw anything overboard.
- Have secure bins or garbage bags to store garbage onboard until you return to shore.
- If garbage does end up in the water, take the time to retrieve it.

Under the Marpol Convention there are strict but simple guidelines for the disposal of garbage at sea.

Waterways and 3 nm from nearest land	3 to 12 nm from nearest land	12 to 25 nm from nearest land	Outside 25 nm from nearest land
Illegal to dispose of plastics and all forms of garbage.	Illegal to dispose of plastics, food waste, cargo packing and, if not ground to smaller than 25 mm, other garbage.	Illegal to dispose of plastics and cargo packing materials.	Illegal to dispose of plastics.

(Note: in Queensland the nearest land is actually considered outside the Great Barrier Reef.)

All vessels that are operating within Queensland coastal waters are required by law to display a placard that describes garbage disposal requirements for the vessel.

The placard must:

- notify the vessel's crew and passengers of the prohibitions and requirements under the *Transport Operations (Marine Pollution) Act 1995* (TOMPA) for the disposal of garbage
- be written in English and, if the vessel is owned or operated in a foreign country, the working language of the vessel's crew.

Sewage

The discharge of sewage from vessels contributes to reduced water quality, poses a human health risk and decreases visual aesthetics of waterways.

Vessel operators and owners must adopt onboard management measures if sewage is likely to be generated, particularly for class 1 ships.

There are simple measures you can take to minimise the risk of sewage being illegally discharged into the sea.

- Know the location of the vessel and be aware of legislated nil discharge areas.
- Ensure that the appropriate valves are closed or opened to direct toilet waste to the sullage tanks instead of overboard. If unsure, always assume the ship is in a nil discharge area until the skipper is consulted.
- Always obtain permission from the skipper before emptying sullage tanks.

Ship-sourced sewage

The following table outlines discharge restrictions in Queensland waters. Please refer to the smooth and partially smooth water limit maps in the appendix at the end of this book.

Prohibited discharge	Prohibited discharge waters No discharge of treated and untreated sewage in: • a boat harbour • a canal • a marina • a buffer zone or a protection zone under the *Marine Parks (Moreton Bay) Zoning Plan 1997*. • Noosa River • areas designated as prohibited discharge areas which are depicted on specific maps on the Maritime Safety Queensland website (www.msq.qld.gov.au). Declared ships (class 1 commercial ships) must have a sewage holding device if operating in areas where discharge is not permitted.
Untreated sewage	Nil discharge waters In those waters where discharge of sewage is permitted, sewage discharged from all boats with a fixed toilet must first pass through a macerator. Smooth waters (includes rivers, creeks and designated smooth waters) • Nil discharge Hervey Bay and northern Moreton Bay waters • Nil discharge within 1 nautical mile from reefs, aquaculture fisheries resources and the mean low water mark of an island or the mainland for vessesl with 1-15 persons on board. • For vessels with 16 or more persons on board – no discharge allowed. • Declared ships – nil discharge. Open waters • For all ships – nil discharge within 1 (nm) of aquaculture fisheries resources or within ½ (nm) of a wharf or jetty (other than a jetty that is a marina) • For ships with 7-15 persons on board nil discharge within 1(nm) of a reef or mean low water mark of an island or mainland. • For ships with 16 or more persons onboard – nil discharge in all Queensland coastal waters.
Treated sewage	In those waterways where discharge of sewage is permitted, sewage discharged from all ships with a fixed toilet must first pass through a macerator. Smooth, Hervey Bay and northern Moreton Bay and open waters Treated sewage can be discharged subject to the following restrictions: • Grade C treated sewage – nil discharge within ½ (nm) of a person in the water, aquaculture resources or a reef. • Grade B treated sewage – nil discharge within 700 metres of a person in the water, aquaculture resources or a reef. • Grade A treated sewage – no restrictions other than prohibited discharge waters. Declared ships (class 1) must have a sewage holding device suitable for the number of persons onboard and the duration of the journey in those waters if operating in waters where discharge is not permitted.

Declared ships are required to have a shipboard sewage management plan onboard with particulars described in Division 3 of the Transport Operations (Marine Pollution) Regulation 2008 and to keep sewage disposal records when discharging to a sewage disposal facility.

All declared vessels with a treatment system are required to carry onboard system maintenance, assessment and service manuals and service records.

Reporting pollution

All marine pollution incidents must be reported to the nearest Maritime Safety Queensland regional office as soon as possible. This report should detail:

- when and where the pollution occurred
- what type of substance was discharged
- extent of the pollution
- name, size and type of vessel
- any other relevant information.

Mariners must be constantly vigilant against pollution risks from their vessel. Even routine operations such as refuelling or pumping the bilges can result in a serious pollution incident.

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CHAPTER 2

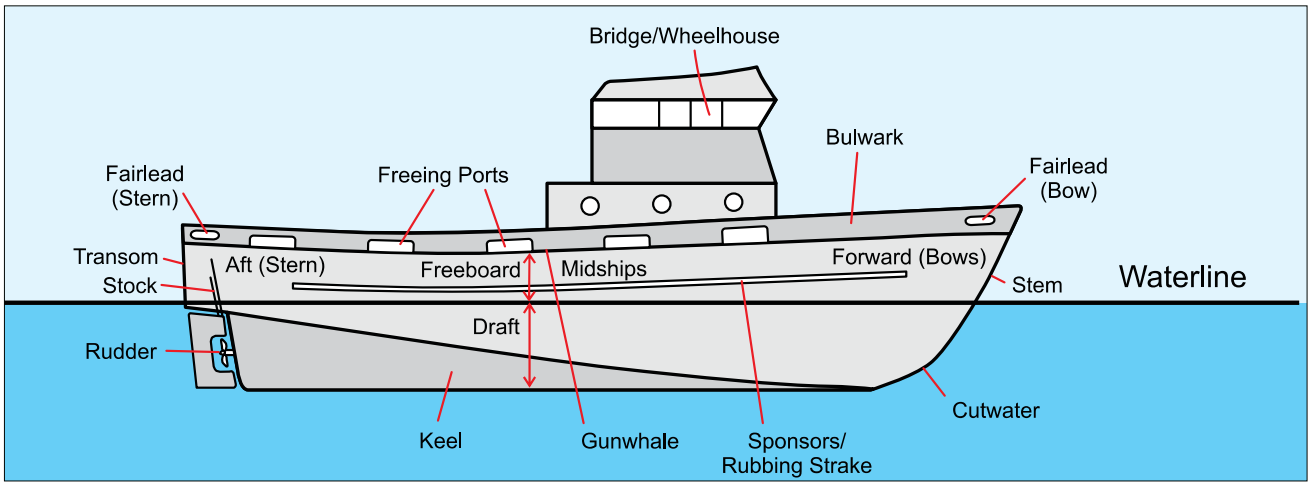
Ship knowledge

Speak the language

The seafarer's lexicon is one of the oldest of all industries and many aspects of it have, over time, been incorporated into everyday language. The following well-known phrases have nautical beginnings: 'letting the cat out of the bag, 'taken aback', being 'at loggerheads' with somebody. The terminology used onboard a vessel is essential knowledge to the new crew member and should be learnt quickly.

Study the below illustration — these are the most basic and important terms that a crew member should be familiar with upon joining their first ship.

There is a glossary at the end of this book with definitions of common nautical terms.



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Propulsion

Propulsion for all vessels comes from three sources — inboard engines, outboard engines and the wind. Sailing vessels will be dealt with in a later section.

Outboard engines

Vessels with outboard propulsion units are different from others in that they lack a rudder. Instead, the whole engine, shaft, gearbox and propeller are rotated by a steering mechanism. This may be a simple tiller, as in the case of smaller units, or a wheel and hydraulic ram arrangement for larger engines — due to the more powerful level of torque that they produce.

Modern outboards differ greatly in size, fuel source and power. But generally most outboard motors use unleaded petrol.

Outboard motors should be used regularly — long periods sitting idle are not good for them. As they are not freshwater cooled, but cooled by seawater, corrosion needs to be considered. To combat this, outboards should be flushed with fresh water as often as possible.

If the vessel is in the water for long periods of time, always raise the leg of the engine clear of the water when not inuse, as weed and coral growth can build up quickly and block the cooling water intakes.

It is strongly recommended that operators of vessels powered with an outboard motor have a throttle lanyard attached to their wrist which will stop the motor instantly should the

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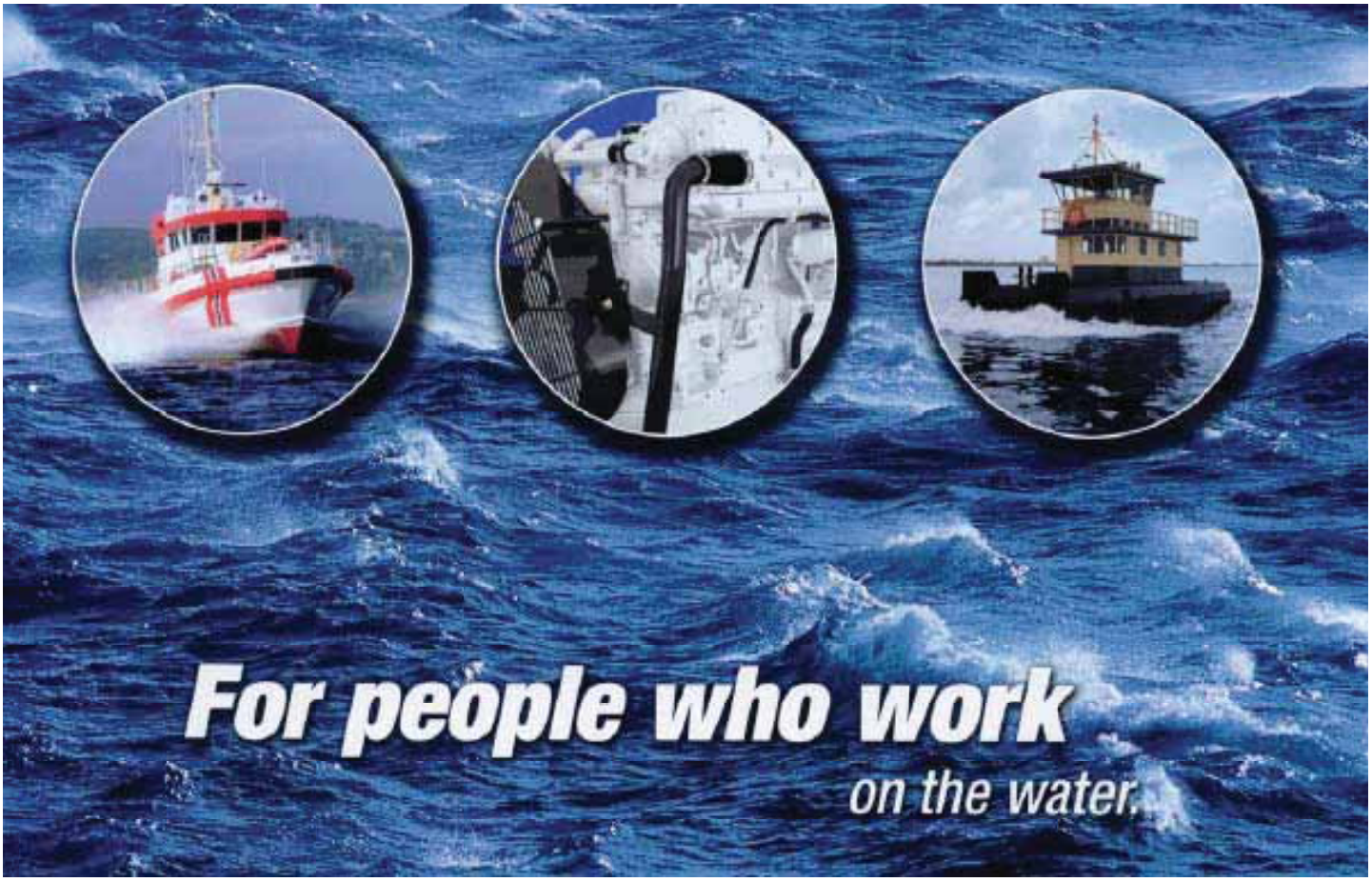

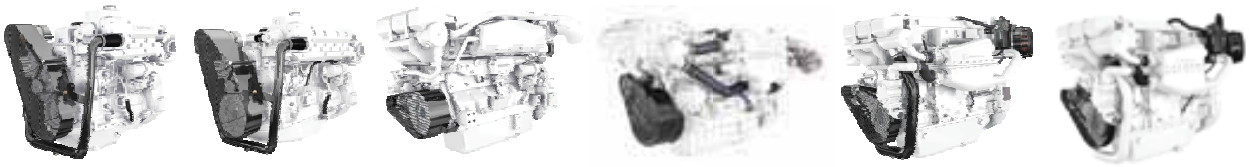

4.5 LITRE	6.8 LITRE	8.1 LITRE	9.0 LITRE	12.5 LITRE	13.5 LITRE
75–150 hp	125-400 hp	235-375 hp	325-500 hp	341-610 hp	425-750 hp

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driver lose control of the boat. There have been fatalities when a driver has been dislodged and fallen overboard in rough conditions or in the event of hitting an object or from vessel wash. This may cause the boat to continue its course or turn in circles. This is an extremely dangerous situation for the person in the water and surrounding vessels.

Inboard engines

An engine room on a commercial vessel is a dedicated compartment designed to house the propulsion unit and usually most other auxiliary machinery as well —such as the generator and refrigeration compressor. It will be fitted with a fixed fire-fighting system and a means of shutting off the ventilation to the compartment in the case of fire.

The main engine itself may vary in configuration. There may be two main engines in the one compartment in the case of a twin screw monohull. These units will always be powered by diesel on commercial vessels. Diesel engines are suited to marine applications due to the much higher flash point of the fuel and the robust nature of diesel machinery.

In a vessel less than 24 metres the skipper will most often act as the engineer onboard as well, however, crew may be given engine room duties by the skipper and it is important for them to know their way around the compartment and wear appropriate personal protective equipment (PPE). The engine room has many more through hull fittings and valves than other compartments and care needs to be taken when operating them.

A 2000 kilowatt diesel engine – main propulsion for a high speed ferry.

An auxiliary diesel engine such as this one may also be present in the engine room. It drives a 240 generator powering refrigeration, air conditioning, lighting and other appliances common on today's commercial ships. Care must be taken when working in a machinery space, as hot surfaces, moving machinery and a great deal of noise make this a hazardous environment at sea. Always wear appropriate PPE.

Hull types and terminology

Vessels differ greatly in design and appearance. It is important to be able to recognise different hull types and hull characteristics.

Monohull

Any vessel with only one hull.

Catamaran

A vessel with two hulls.

Multihull

A vessel with two or more hulls. A vessel with three hulls is called a trimaran. Broadly speaking, vessels are either monohulls or multihulls.

Cathedral hull

A cathedral hull, or stabilised monohull, is designed to provide greater initial stability. The vessel is less inclined to list due to greater buoyancy outboard of the centreline.

Wave piercer

A catamaran vessel with a central hull clear of the water. The outboard hulls are designed to go through, rather than over, waves.

Deadrise

The angle of the bottom of a vessel compared to the horizontal plane. It is measured from the midships (middle section of the hull). The angle of deadrise has a great influence on the handling and seakeeping attributes of a vessel.

Deck camber

The convex upward curve of a deck. Its function is to increase the load bearing capacity of the deck and also to allow water to run overboard rapidly through the freeing ports.

Bow flare

The outward sweep of a vessel's bows. As the vessel sinks down into oncoming waves, the beam and internal underwater volume of the hull increases, providing greater reserve buoyancy. It also tends to force water away from the bows when the vessel pitches into a seaway.

Tumblehome

The curve of a vessel's topsides back inboard towards the centreline of the hull. A vessel with tumblehome has its greatest beam below the gunwale. It is a common design feature of many yachts.

Sheer

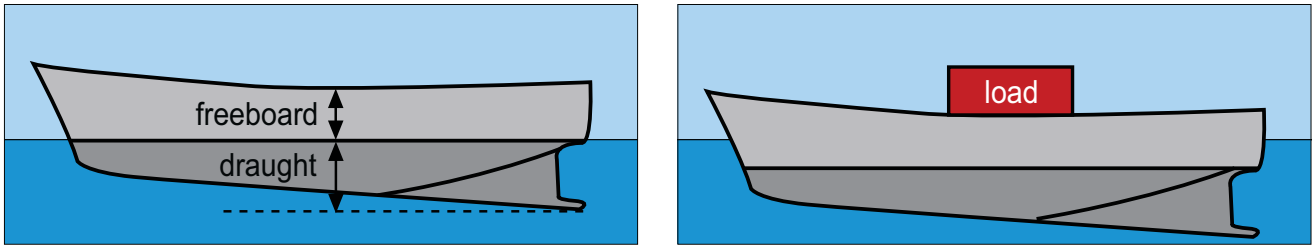
The sweeping curve of the deck line — usually upwards towards the bow and stern and lowest amidships. Sometimes a vessel may have a flat sheer, such as a barge or tanker, or even a reverse sheer, such as a modern sports cruiser.

Buoyancy and stability

Crew members should have a sound knowledge of buoyancy and stability concepts to ensure that the vessel won't be overloaded over the course of its activities while at sea.

Key terms

Buoyancy is the upward force on a vessel derived from the displacement of a weight of water equal to the weight of the vessel (produced by watertight volume below the waterline).



Freeboard is the vertical distance from the lowest point of the main deck (usually near midships) to the waterline.

Reserve buoyancy is the watertight volume of a ship above the water line. That is, the distance from the waterline to the uppermost continuous deck. As fish catch is added to the hold, the freeboard will reduce and the draft will increase. The ship will have less reserve buoyancy.

Stability is the ability of the ship to remain upright. It is determined not only by the design of the vessel, but also by crew members by determining the amount and distribution of weight onboard.

Because the design of the ship cannot be controlled, it is vital to control the amount and distribution of weight onboard.

The stability of the ship is mainly determined by the distance between two points:

- Centre of gravity — the point of the ship where the weight of the whole ship and everything in it is said to act vertically downwards due to the force of gravity.
- Centre of buoyancy — is the point at the centre of the ship's underwater volume where the force due to buoyancy is said to act vertically upwards.

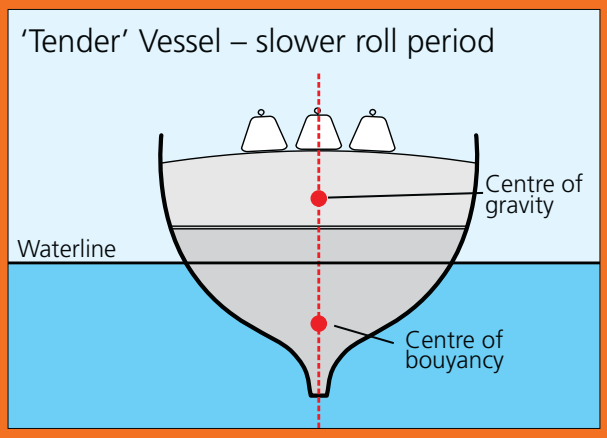
Overloading is dangerous and one of the easiest ways to capsize a vessel. The more weight in the boat, the lower the freeboard. Overloading compromises the safety of everyone onboard and increases the chance of swamping or capsizing.

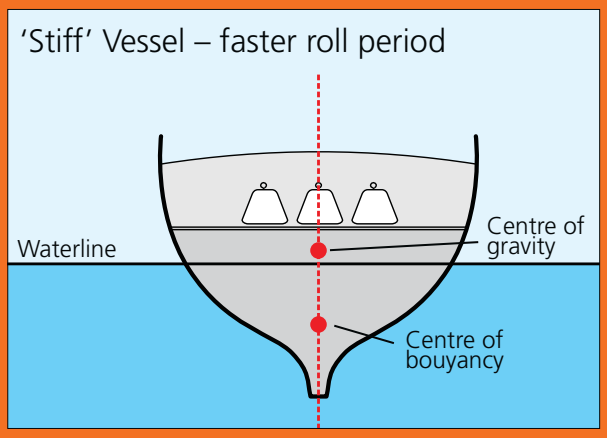
When preparing for a trip, the master is responsible for assessing the load onboard — both people and objects. For example:

- Heavy items should be stowed in a low and central place where they cannot move around.
- Weight, including passengers, should be distributed evenly through the boat.
- The weight of extra fuel and water should be taken into account.

Case Study

Study the same vessel loaded with cargo in two different ways:





The loading condition on the left is less stable because the distance between the centre of gravity and the centre of buoyancy is greater. This vessel would be referred to as 'tender' as its rolling period (the time it takes to compete a roll from one side to other and back again) is longer. The vessel on the right is referred to as 'stiff' as its rolling period would be shorter. In adverse conditions, this vessel would be less likely to capsize.

Free surface effect has the same result on the stability of the ship as raising the centre of gravity. It occurs when free moving weight onboard such as a half full water tank, sea water on the deck or an uncontained catch of fish on the deck, is moved about by the action of the sea on the vessel. For example, if a vessel takes a heavy sea onboard and the freeing ports are closed or blocked, the action of tonnes of water moving to one side of the vessel changes the stability of the ship and may result in capsize. Where possible, tanks should always be kept pressed up (full) or empty to reduce free surface effect. In a larger ship, the combined effect of many slack (partially full) tanks on the overall stability of the ship can be considerable.

This ship's stability was not monitored correctly during loading operations at the dock, with disastrous results!

Deck fittings, equipment and machinery

Bollards, bitts and **cleats** differ in design, but their general function is the same — to belay or fasten a line. Methods are covered in chapter 5 (seamanship).

Hatches are openings in the deck that may be closed and clamped to maintain the watertight integrity of the hull. Often, these hatches have a raised perimeter around them called coamings that prevent the down flooding of any water that may be on deck when the hatches are open.

Hatch with coaming on a vessel in 2B survey.

A **windlass** is a device used to haul in lines or chain under load. On most small vessels the only windlass onboard is used for setting and retrieving the anchor. On some vessels, however, the windlass can be used to haul nets and other fishing equipment.

Cranes are a common piece of deck equipment, even on small vessels. They may be electrically or hydraulically driven and used to stow tenders and other heavy equipment on deck. Close attention to the stability of the ship is necessary when using cranes, as the centre of

gravity of the load actually acts from the very end of the boom. Usually this is well outboard from the centreline of the ship when in operation and can cause the ship to list.

A **derrick** is a boom used for lifting heavy weights. Derricks are often used to haul nets on fishing vessels and similar stability issues as cranes are encountered, particularly when hauling nets abeam rather than astern.

This vessel uses a derrick rather than a crane for handling cargo.

Most accidents at sea occur on deck. Make sure you are trained in the use of deck machinery and always wear PPE appropriate for the task. Deck machinery is under tremendous load and, combined with the ship's motion, requires great care to be taken when operating.

Steering

There are many different methods of steering a vessel and the methods differ between ships. It may be as simple as a tiller held in the hand or as complex as a power-assisted hydraulic system.

All commercial vessels are required to have a means of emergency steering should the main system fail. The rudder of any vessel is under massive load when at sea and wheel steering arrangements usually employ some system of mechanical or hydraulic advantage to ease the effort of steering the ship and holding a course.

Twin engine vessels may be steered by adjusting the revolutions of each propeller

should the steering system fail. (This is easier in catamarans than it is in monohulls due the wide separation of the propellers.)

Electrical systems

Commercial vessels often run 12, 24 and 240 volt electrical systems onboard.

A DC circuit breaker panel on a small commercial vessel. Fire alarm, warning lights, engine instruments, voltmeter and ammeter are also incorporated. A separate panel exists for the AC system.

Batteries, often linked together in banks, provide 12 and 24 voltage, while a mechanically powered alternator known as a genset provides 240 volts to the ship.

Batteries need careful monitoring and maintenance. The master or engineer will usually assign this duty to a crew member along with other engine room duties. Batteries contain corrosive fluid, and also produce highly explosive hydrogen gas, particularly when they are charging, so occupational health and safety procedures must be followed when monitoring and maintaining the vessel's batteries.

Commercial vessels have a larger requirement for AC (alternating current, or 240/415 volt) systems than recreational vessels. Batteries cannot run equipment such as large refrigeration units, floodlights or electric ovens and deep fryers. In the engine room there will be a separate diesel engine from the main propulsion engine that drives an alternator-producing AC power. On fishing vessels, this unit usually runs 24 hours a day when at sea and requires careful and regular monitoring and maintenance.

CHAPTER 3

Emergency and safety

The sea is a dangerous place to work. If things go wrong, it can take time for search and rescue or emergency services to respond — crew must have a very broad knowledge of several skills in order to control the emergency situation.

It is the master's responsibility to ensure that crew members are trained in all aspects of emergency procedures onboard the vessel. The master cannot save the ship without the support of a strong and professional team. For this reason the crew should know where the emergency equipment is located and how to use it before beginning a journey to sea and must participate in any emergency drills that are conducted while onboard so that they are prepared for any emergency that may arise.

Safety induction

Before heading out to sea for the first time as a crew member on a vessel, a safety induction must be carried out. This involves a tour of the ship to learn the location of all the emergency equipment onboard. Crew members must familiarise themselves with the emergency station list, which outlines what their duties are in the event of a variety of emergencies. Once this is done, an entry will be made in the ship's safety management system and initialled by the crew member and the master. This is a legal declaration stating that the induction has taken place.

Duties in an emergency

The crew of a commercial vessel should be a well-oiled machine and nowhere should this be more evident than in the event of an emergency. The skipper will provide training in the use of all emergency and safety equipment onboard, but crew members should also never be afraid to ask questions or research information themselves.

The emergency station list

Also known as a muster list, these provide information about the responsibilities of each crew member in an emergency. The emergency station list must be displayed in conspicuous locations throughout the vessel including the wheelhouse and crew accommodation areas, if at least one of the following applies:

- a vessel with four or more crew
- there is at least one berthed passenger
- there are more than 36 unberthed passengers
- the voyage is longer than 12 hours.

The emergency station list also outlines the general emergency signal and abandon ship signal. On passenger ships, lists are provided in each cabin and assign a muster station for each occupant as well as instructions for putting on life jackets.

Some of the duties, based on a crew of five, in the event of an engine room fire may include:

- Master — bridge, in command.
- Engineer — ascertain fire state/shutdown main engines; close engine room ventilation flaps and fuel supply and report to the master; activate fixed fire-fighting system if required.
- First mate — liaise between master and crew; communications; sounding of emergency station alarm; assist master.
- Deckhand — prepare emergency equipment including liferafts, EPIRB and so on.
- Steward — head count at muster station; distribute PFDs; passenger control; report to first mate.

Drills

Along with knowing the required duties in the event of an emergency, crew members must participate in drills to ensure familiarity with assigned duties. It is up to the ship's owner to determine

the frequency of drills so that crew members are confidently able to make rapid and effective responses to emergency situations.

Safety equipment on commercial vessels

National Standard for Commercial Vessels (NSCV) part C, subsection 7A — Safety equipment standard

All Australian maritime authorities require vessels to carry a certain amount of safety equipment. This is determined by vessel type, purpose, area of operation, length and the number of people onboard. Further information on safety equipment standards for various classes and lengths of vessels and area of operation can be found by reviewing the NSCV or through factsheets available on the Maritime Safety Queensland website.

All owners and masters of commercial vessels should be familiar with the sections of the NSCV that concerns the registration class of their vessel.

Examples from National Standard for Commercial Vessels (NSCV) C7A — Safety equipment standard	
Class 2C Non-passenger vessels — between 15 metres and less than 25 metres in length	
Seagoing non-passenger vessel, from 15 metres and less than 25 metres in length, for use in all operational areas up to and including restricted offshore operations. (Restricted offshore operations: operations within a limit of 50 nautical miles seaward from designated smooth or partially smooth waters, designated restricted offshore waters or a safe haven.)	
Liferafts and rescue boats	Inflatable coastal liferaft(s) for 100% of allowable crew and any other persons onboard
Lifebuoys	2 x lifebuoys: 1 with a light; 1 with a buoyant line
Lifejackets	Coastal life jacket with light for 100% of allowable crew and any other persons onboard
Distress signals	1 x 406MHz emergency position indicating radio beacon (EPIRB) 3 x parachure distress rockets 2 x red hand-held flares 1 x orange hand-held smoke flare
Onboard communications and alarm systems	General emergency alarm system
Emergency lighting (hand held)	1 x battery operated torch for each crew member
Medical supplies	Annex H: Scale F of Table H.3 — the quantity of medical supplies identified in Annex H is based on incidents involving 1 or 2 persons only Medical supplies will need to be expanded in accordance with the particular risks inherent to the voyage and the number of persons onboard

Examples from National Standard for Commercial Vessels (NSCV) C7A — Safety equipment standard	
Class 1C Passenger vessels — between 10 metres and less than 25 metres in length	
Seagoing passenger vessel, from 10 metres and less than 25 metres in length, for use in all operational areas up to and including restricted offshore operations. (Restricted offshore operations: operations within a limit of 50 nautical miles seaward from designated smooth or partially smooth waters, designated restricted offshore waters or a safe haven.)	
Liferafts	Inflatable coastal liferaft(s) for 100% of allowable crew and any other persons onboard
Lifebuoys	2 x lifebuoys: 1 with a light; 1 with a buoyant line
Life jackets	Coastal life jacket with light for 100% of allowable crew and any other persons onboard
Distress signals	1 x 406MHz emergency position indicating radio beacon (EPIRB) 3 x parachure distress rockets 2 x red hand-held flares 1 x orange hand-held smoke flare
Onboard communications and alarm systems	Public address system (if no effective means of addressing passengers in time of emergency)
Emergency lighting (hand held)	1 x battery operated torch for each crew member
Medical supplies	Annex H: Berthed passengers Scale E of Tables H.4 and H.5 and Scale F of Table H.3 unberthed passengers Scale F of Table H.3 — The quantity of medical supplies identified in Annex H is based on incidents involving 1 or 2 persons only. — Medical supplies will need to be expanded in accordance with the particular risks inherent to the voyage and the number of persons onboard

Examples from National Standard for Commercial Vessels (NSCV) C7A — Safety equipment standard	
Class 3B fishing vessels — less than 15 metres in length	
Seagoing fishing vessel, less than 15 metres in length, for use in all operational areas up to and including offshore operations. (Offshore operations: operations within a limit of 200 nautical miles to seaward of the coast)	
Liferafts	Inflatable coastal liferaft(s) for 100% of allowable crew and any other persons onboard
Lifebuoys	1 x lifebuoy with a light
Life jackets	Adult SOLAS life jacket with light for 100% of allowable crew and any other persons onboard plus a child size SOLAS life jacket with light for each passenger less than 32kg
Distress signals	1 x 406MHz emergency position indicating radio beacon (EPIRB) 6 x parachure distress rockets 4 x red hand-held flares 2 x orange hand-held smoke flares
Onboard communications and alarm systems	Public address system (if no effective means of addressing passengers in time of emergency)
Emergency lighting (hand held)	2 x battery operated torches
Medical supplies	Annex H: Scale E of Tables H.4 and H.5 and Scale F of Table H.3 The quantity of medical supplies identified in Annex H is based on incidents involving 1 or 2 persons only. Medical supplies will need to be expanded in accordance with the particular risks inherent to the voyage and the number of persons onboard

Compliance in this area is very important and the onus is on masters and owners to ensure their ship is kept equipped and operated according to its class of registration. For example, if a fire onboard a passenger ship resulted in death or injury and it was found that the fire-fighting appliances onboard the vessel were not compliant with its class of registration, serious penalties would apply to both the owner and the master of that ship. If a ship was navigating outside of its area of operation this also would be a serious offence.

Inflatable liferaft

The inflatable liferaft is the most common survival craft carried by small commercial ships. It is stored on deck in a fibreglass container and secured to the vessel using a hydrostatic release mechanism. This mechanism cuts the securing lines at a depth of two or three metres and is activated by water pressure. This allows the liferaft to rise to the surface in the event of the ship sinking. Correct installation of this equipment is essential to ensure that in the event of a vessel capsize, the liferaft will be released hydrostatically. Inflatable liferafts vary greatly in size — typically carrying between four and 60 people. They are designed to endure exposure for 30 days at sea in all conditions and are stocked with equipment and rations such as an EPIRB, sponges, paddles, bailer, knife, electric torch, food, a first aid kit and fishing equipment.

A hydrostatic release.

Life rafts are complex pieces of equipment and must be inspected by an authorised servicing company every year.

A ten person life raft thrown overboard and inflated by giving a sharp tug on its painter.

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Lifeboats

Most new cargo ships are fitted with totally enclosed lifeboats. Older ships may have open, or partially closed types, but all lifeboats will have their own davits from which they are launched. Lifeboats have their own engines for propulsion, and are equipped with rations and emergency equipment.

'Free-fall' lifeboats are usually stowed at the stern of larger new ships. Crews must be drilled in their use and the passengers of a lifeboat should be able to board within three minutes.

A class 1 passenger ship lifeboat stowed on extendable davits.

Carly floats

On the highest deck of many vessels large, orange objects are often visible. These are carly floats and consist of buoyant material with a fibreglass shell and lines on the edge that survivors in the sea can cling too. If they are fastened down to the deck they must be fitted with a hydrostatic release. More commonly they sit in cradles on the deck so that they may float free in the event of the ship sinking.

Although fastened to the deck with lines, these floats will also float free as they are fitted with a hydrostatic release mechanism visible on the left of the picture. These devices must be inspected annually by an authorised person.

Life buoys

These are located around the ship in specially-designed holders that allow a person to throw them quickly overboard to someone in the sea. Some will be attached to the ship by a very long painter that must be coiled in such a way that it will not foul when the buoy is thrown overboard. Others will not have a painter but will be equipped with a light that will automatically turn on in contact with the sea. The life buoy must display some kind of identification of the vessel, for example the registration number, name of the vessel or home port.

Personal flotation devices (PFDs)

Also referred to as life jackets, they must be regularly inspected and maintained, fitted with the correct accessories and be stowed in clearly marked, easily located and readily-accessible areas.

Coastal, or SOLAS (Safety of Life at Sea), life jackets are the most commonly-used onboard commercial ships. They have retro reflective tape and a light and whistle attached to them, as well as a collar to keep the head above the water in case of unconsciousness.

Crew members must be familiar with how to correctly put on on a life jacket and will be required to demonstrate this to passengers onboard.

An example of safety equipment.

Emergency position indicating radio beacon (EPIRB)

One of the most important life saving devices on a commercial vessel is an EPIRB. Often these are secured to the vessel using a hydrostatic release that is water activated, deploying the beacon automatically if the vessel sinks. An EPIRB can also be deployed manually where a distress situation exists and the vessel continues to float.

Beacons developed for the Cospas-Sarsat satellite system operate on the 406 MHz frequency and use digital technology that allows the beacon to transmit a unique code (HexID or UIN) that identifies the beacon. 406 MHz beacons come in two basic types: those that provide an encoded (GPS) location and those that do not. The satellite system can calculate a beacon's location, but locating a site is usually much faster if the beacon signal provides a GPS location.

The transmission from a 406 MHz EPIRB can be stored, carried and then forwarded when a local user terminal (LUT) comes in view, therefore global coverage is achieved.

EPIRBs are designed to float in the water to optimise signal strength to the satellite. An EPIRB is required to operate for a minimum of 48 hours continuously once activated and is equipped with a lanyard that is used to secure it to something that is not going to sink, so that it can float free.

HexID or unique identity number (UIN)

The HexID, or UIN, is the unique code programmed into each 406 MHz EPIRB that is transmitted when the beacon is activated. This number is registered with the Australian Maritime Safety Authority (AMSA) and the code links the individual distress beacon to the registration database. This allows the vessel to be identified if the EPIRB is activated.

An EPIRB is a last resort — other equipment such as v-sheets, flares and marine radios should be used in the first instance. Often, rescue authorities may instruct the crew over the radio to activate their EPIRB in the final stages of the search and rescue process. Should an EPIRB be activated inadvertently, even for a minute or two, it is important to report the activation to the Rescue Coordination Centre on 1800 641 792, or alternatively a local volunteer marine rescue organisation. There is no penalty for accidental activation and this report will save a lot of effort from search and rescue authorities.

Distress flares

Distress flares are used to attract the attention of passing vessels or aircraft for assistance. There are three different types of flares carried onboard commercial ships: orange smoke (pictured), red hand held and red rocket.

Different brands of flares will have different methods of ignition depending on the manufacturer — it is important to know what type the vessel is equipped with. All flares have an expiry date three years from their date of manufacture — after this date they must be replaced and the old flares disposed of correctly. Flares are classed as explosives and flammables and become unstable over time, so they should be disposed of appropriately, Flare disposal locations can be found on the Maritime Safety Queensland website (www.msq.qld.gov.au).

Emergency portable lighting

All crew should have access to their own torch to be used as a signalling device in an emergency. Cyalume sticks, which are small plastic cylinders that produce light from a chemical reaction when bent, can also be used for lighting.

Alarms

During emergency drills onboard, alarms should also be tested to ensure they are operational and to familiarise the crew with what each alarm sounds like. For example, fire detection alarms are usually a loud electronic beeping from the alarm panel in the wheelhouse. This is automatic and will be followed by the general fire alarm — usually the continuous ringing of a bell.

Some other alarms include:

- General muster/emergency station — seven short and one long blast of a sound signal.
- Abandon ship — one long, blast followed by one short blast of a sound signal at least three times ('A' in Morse Code).

- Various system failure alarms — such as electrical system failure, engine alarms and so on.

Line throwing apparatus

Many ships are equipped with a rocket line throwing apparatus capable of throwing a light line over 200 metres. This is used to transfer lines to another ship or the shore to aid in the retrieval of survivors or liferafts.

Fire-fighting equipment

Fire is one of the most common emergencies onboard vessels so training in the use of fire-fighting equipment is essential for all crew members.

Fire extinguishers

There are six fire extinguisher types found aboard commercial vessels:

PORTABLE FIRE EXTINGUISHER GUIDE

	WATER	WET CHEMICAL (Previously Beige)	FOAM (Previously Blue)	DRY CHEMICAL POWDER AB (E) B (E)	CARBON DIOXIDE (CO_2)	VAPORISING LIQUID
						
A Ordinary Combustibles (Wood, Paper, Plastics, etc)	YES Most Suitable	YES	YES	YES AB (E) NO B (E)	LIMITED	YES
B Flammable & Combustible Liquids	NO	NO	YES	YES	LIMITED	LIMITED
C Flammable Gases	NO	NO	NO	YES	LIMITED	LIMITED
(E) Fire Involving Energised Electrical Equipment	NO	NO	NO	YES	YES	YES
F Fire Involving Cooking Oils & Fats	LIMITED	YES	LIMITED	YES AB (E) LIMITED B (E)	LIMITED Limited Effectiveness	NO

These extinguishers are used to quickly respond to a fire before it has become extensive. The appropriate fire extinguisher will usually be found in the vicinity of a particular risk.

For example:

- Accommodation spaces may be equipped with dry chemical extinguishers because the fuel will usually be solid.
- Electrical or machinery spaces may have carbon dioxide extinguishers.
- The galley may have a foam extinguisher as these are most effective on cooking fat and oil fires.

Right: Fire extinguishers are red with a band of colour around them for rapid identification.This one has a white band indicating that dry chemical is the extinguishing agent. It also has a test date stamp tag and a gauge indicating its charge state. All extinguishers need to be inspected by a technician every six months in accordance with Australian Standard 1851.

Hydrants, hoses and nozzles

Hydrants and hoses are vitally important for the cooling operations during a fire onboard and a spray-jet nozzle acts to minimise the water volume being used. Ensure the nozzle is adjusted to the spray pattern as it will help smother, rather than spread, the fire.

When using a fire hose, be aware of the amount of water that will collect inside the vessel and pump it out if necessary as it may affect the stability of the ship.

Be careful using water on a fire if it involves liquid fuel. Usually all that will be achieved is a rapid spreading of the flames as the fuel is splashed about.

Fixed fire-fighting systems

Most engine rooms will be fitted with a fixed fire-fighting system. The extinguishing agent is often carbon dioxide (CO_2) or modern agents such as FM200. Fixed fire-extinguishing systems are designed to flood the area with an agent (usually aerosol, gas or mist) to suppress the fire and extinguish it. These systems can be automatically or manually triggered and an alarm will sound before the release of the agent to allow evacuation of the compartment.

Fire blankets

Fire blankets are common in the galley of a vessel where fat fires are a high risk. They are highly effective at smothering fires that are contained in something such as an oil drum or a frypan. Carefully place the blanket over the fire to extinguish it.

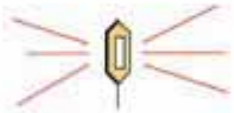
Bucket

Buckets are a legal requirement onboard to aid in fire fighting. They may be used to douse a fire with water.

Distress signals

Crews should be aware of ways to attract attention when the ship is in distress. The following list of signals is part of the *International Regulations for Preventing Collisions at Sea, 1972* (Annex IV) which are recognised internationally.

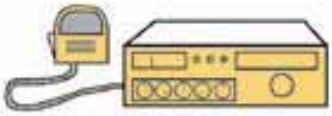
1. A gun or other explosive signal at intervals of about one minute.



2. A continuous sound signal with any fog-signalling apparatus.

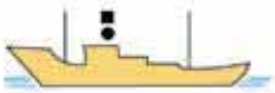
3. Rockets or shells throwing red stars fired one at a time at short intervals.

4. A signal made by any device consisting of the morse group SOS.

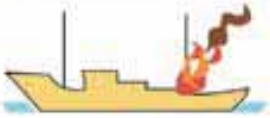


5. The spoken word MAYDAY sent by radiotelephony.

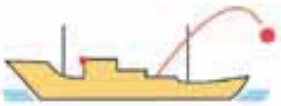
6. The international code signal indicated by N over C.



7. A signal consisting of a square flag having above or below it a ball or anything resembling a ball.



8. Flames on the vessel.



9. A rocket parachute or hand flare showing a red light.

10. An orange smoke signal.

11. Slowly and repeatedly raising and lowering both outstretched arms.

12. Signals transmitted by EPIRBs.

13. V-sheets.

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Marine radio

An essential and legal requirement for all commercial vessels is to have an appropriate marine radio onboard as well as someone who is licensed to operate it or supervise its operation. This means that any crew member may be required to operate it under the instruction of the master, even though that crew member may not hold a licence.

A restricted Marine Radio Operator's Certificate of Proficiency is usually the minimum requirement for the master and is issued by the Australian Communications and Media Authority (www.acma.gov.au). Courses are held regularly in most areas.

The most common radio onboard is the VHF (very high frequency) radio. Channel 16 is the dedicated distress and calling frequency and channel 67 is the supplementary distress frequency. Class B, C and D vessels operating further than 20 nautical miles from a coast station or limited coast station require HF (high frequency) radio under the NSCV. This radio is capable of long distance communication and is more complex in its operation and range of frequencies.

Most modern marine radio sets are equipped with digital selective calling (DSC). DSC capable radio sets (both VHF and HF) can transmit a burst of digital data that contains details of the ship and the nature of the distress with the press of a button. If the radio is interfaced with GPS (global positioning system), then the ship's location in latitude and longitude is also transmitted.

Due to the introduction of DSC, a compulsory listening watch on VHF channel 16 is no longer required for large trading ships. However, in recognition that many smaller recreational and commercial ships remain reliant on more traditional radiotelephony (spoken word) procedures, Australian authorities encourage the constant audible monitoring of channel 16 on the bridge at all times.

The Marine Radio Operators Handbook, published by the Australian Maritime College, is available from most marine retailers and deals specifically with VHF radio procedures

Operating procedures

Standard radio procedures are used by boats of all nationalities.

Standard calls

When making a standard call to another boat or volunteer group state clearly:

- the boat/group you are calling — spoken three times
- this is — name of the boat — spoken three times
- message
- over
- await response.

Distress calls

The distress call 'mayday' may be used only if the boat is threatened by grave and imminent danger and immediate assistance is required. This distress call has absolute priority over all other transmissions and may only be transmitted on the authority of the skipper or the

person responsible for the safety of your boat.

Call procedure:

- mayday mayday mayday
- this is — name and radio call sign of boat in distress — spoken three times
- mayday
- name and radio call sign of boat
- details of boat's position
- nature of distress and assistance required
- other information including number of people onboard.

Urgency calls

The urgency call should be used when the use of a distress call is not justified but a very urgent message needs to be transmitted concerning the safety of the boat or the safety of a person onboard. Once again, an urgency call may only be made on the authority of the skipper or person responsible for the safety of the boat.

Call procedure:

- pan pan pan pan pan pan
- hello all stations hello all stations hello all stations
- this is — name and radio call sign of boat — spoken three times
- details of the boat's position
- details of assistance required and other information.

Safety calls

The safety call should be used to broadcast an important navigational warning to other stations. For example, if a large floating object that could damage the hull of a boat has been sighted.

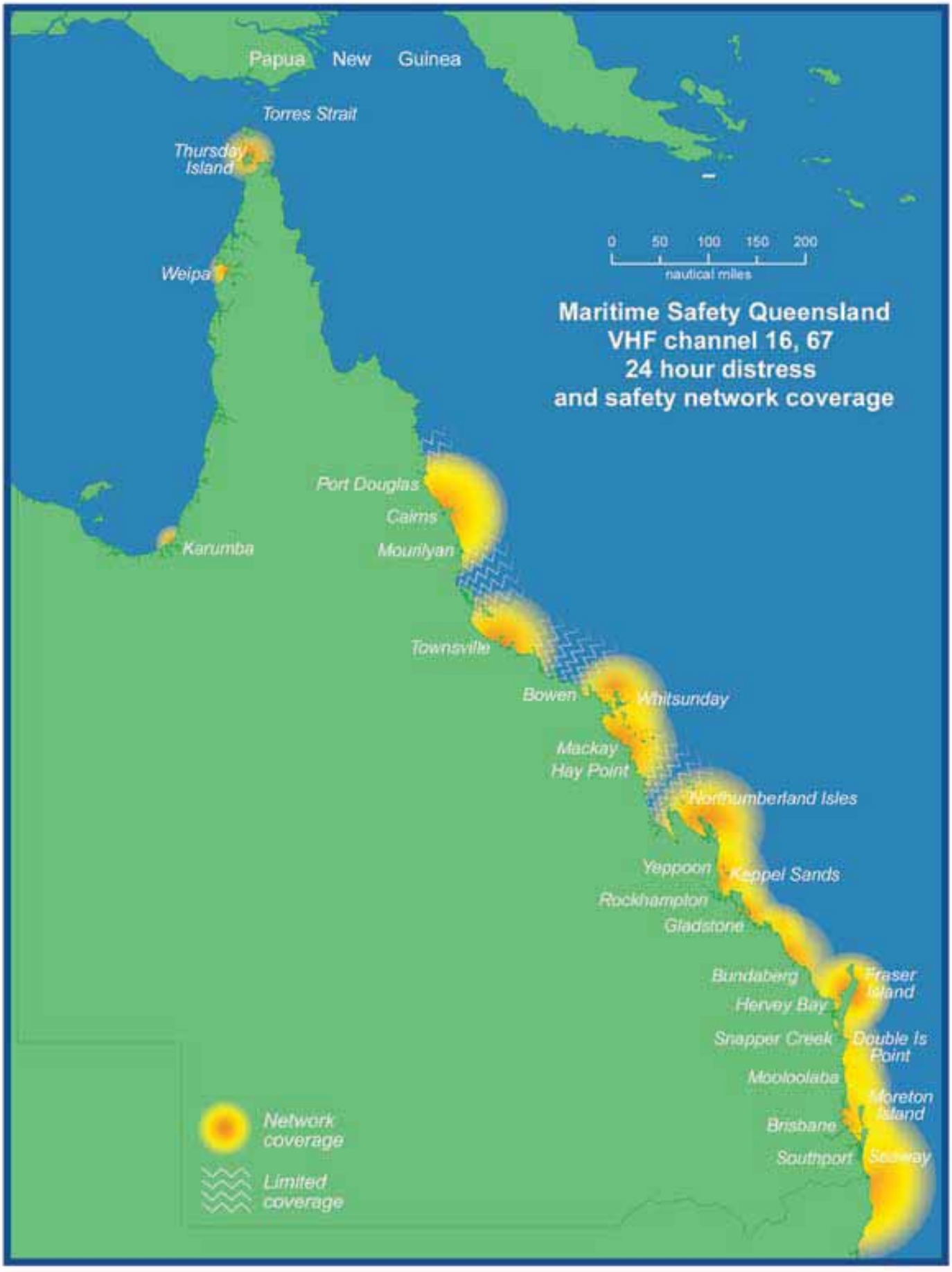
A safety call is more likely to be made by a coast station or a limited coast station operated by a marine rescue association and may include important weather warnings such as severe thunderstorm, gale and cyclone warnings.

Call procedure:

- say-cure-e-tay say-cure-e-tay say-cure-e-tay
- hello all stations hello all stations hello all stations
- this is — name and radio call sign of boat or shore station — spoken three times
- details of the warning.

The safety message should be broadcasted on a working frequency.

The master of a vessel is required to respond to a distress call. If the vessel in distress is beyond doubt a long distance away, then wait a few minutes for a closer vessel to respond. If there is no response then your vessel should acknowledge the call and relay the distress message to an appropriate station. Details on all aspects of marine radio operation can be obtained from the Marine Radio Operators Handbook issued by the Australian Maritime College and Office of Maritime Communications.


Papua New Guinea
Torres Strait
Thursday Island
Weipa
Karumba
0 50 100 150 200
nautical miles
Maritime Safety Queensland
VHF channel 16, 67
24 hour distress
and safety network coverage
Port Douglas
Cairns
Mourilyan
Townsville
Bowen
Whitsunday
Mackay
Hay Point
Northumberland Isles
Yeppoon
Keppel Sands
Rockhampton
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Case study

In September 2002 the 12.2 metre steel fishing boat, *Tamara*, was at sea on a voyage from Southport, Queensland to Western Samoa with two crew onboard. Prior to departure, modifications had been made to the vessel that were not inspected by a surveyor. The most critical of these included a reduction in height of the engine room, ice room and steering compartment hatch coamings in the deck from 300 mm to only 75 mm high. Also, the bulwarks around the main work deck had been raised by 500 mm, but the freeing ports at the base of these bulwarks (that are designed to allow any water to rapidly run overboard), had been partially welded up. Below deck, watertight bulkheads had also been penetrated.

The master, while having considerable commercial fishing experience, was qualified as a Coxswain which restricts the holder to operating vessels less than 12 metres in length in inshore waters. The deckhand had no qualifications, minimal seagoing experience and was not familiar with the operation of the *Tamara's* safety equipment.

When about 140 nautical miles east of the Queensland coast in a following sea of 4-6 metres, the master opened the hatches to investigate the source of black smoke that he had noticed. While the hatches were open, the ship took a wave over the stern. Trapped by the high bulwarks and aided by the low hatch coamings and lack of drainage through the modified freeing ports, a large amount of water rushed down the hatches. Modifications to the watertight bulkheads below decks meant that flooding in one compartment would quickly spread to another, as they had lost their watertight integrity. The pumps could not cope with the large volume of water and the *Tamara* sank very quickly. The master did not have time to retrieve the EPIRB from inside the wheelhouse or prepare any other emergency equipment — even life jackets.

The liferaft, which had been stowed on the top of the wheelhouse, popped up nearby and inflated thanks to a hydrostatic release mechanism and the men clambered inside. They remained in the liferaft for the next 14 days with four litres of water, some dry biscuits and other emergency equipment that was inside the raft — but no EPIRB and no radio.

They were eventually found 30 miles from the coast by a fishing boat. No one knew of their plight for many days after the sinking as the crew had not organised regular radio contact with any individual or organisation. Only after they were reported overdue at their destination, nearly 450 miles from the position of the sinking, was the alarm raised. The vast area involved and the lack of any indication that the *Tamara* was in distress, meant that a search was impractical.

Only pure luck and the correct stowage of the liferaft with a hydrostatic release saved their lives.

Crew members must:

- Know where life jackets are stowed and how to put them on quickly.
- Know the assigned duties on the emergency station list.
- Know the emergency, fire and abandon ship signals.
- Know the escape routes and emergency exits of the vessel.
- Know the location of all emergency equipment onboard and be proficient in their operation.

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Are your details up to date?

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www.amsa.gov.au/beacons

1800 406 406

Australian Government

Australian Maritime Safety Authority

121.5 MHz EPIRBs and PLBs are no longer licensed for use. Please dispose of old beacons responsibly.

Working safely

Personal protective equipment (PPE)

Crew members should participate in and encourage a safety culture onboard, making it a habit to wear PPE. PPE is clothing and equipment that protects the wearer from injury when participating in work-related activities. Crew members are required to wear PPE as part of their occupational health and safety requirements.

Examples of PPE include:

- ear plugs
- hard hat
- safety boots
- gloves
- visibility clothing.

Confined spaces

Many incidents at sea have occurred as a result of working within confined spaces. The possible confined spaces onboard a vessel include those spaces entered through small hatchways or access points, cargo tanks and ballast or oil tanks. Confined spaces are not normally work spaces but may need to be entered on occasion for maintenance to be carried out.

Many fatalities have occurred in confined spaces due to preparations and procedures not being followed. The main hazard associated with confined spaces is an oxygen-depleted atmosphere. Even a rusty tank can have an atmosphere that will not support life. Other hazards can be the toxic effects of sewage systems, paint fumes, refrigeration, fuel tanks and stagnant bilge water.

Before entering a confined space:

- Assess the work that is required and plan to reduce time in the space.
- Inform the master of the work that is going to be undertaken.
- Develop a safe system that suits each job and clearly define safe methods of work.
- Ventilate the compartment — depending on circumstances, this may take 24 hours or more. If fans or blowers are used in a potentially explosive atmosphere they must not be capable of giving off sparks.
- Wear appropriate PPE such as masks or breathing apparatus, boots and a hard hat.
- Have a coworker remain stationed outside the compartment with a safety line tethered to the person inside the space.
- Have a rescue plan and a work plan established before entering the space.

Additional checklists may be required for monitoring during entry and after exit.

Detailed information on safe work practices in confined spaces can be found from the Department of Mines and Energy (www.dme.qld.gov.au).

Risk assessment and hazard management

Procedures and documentation should be kept on the vessel to identify hazards and the risk they present, implement control measures for identified risks and also monitor the effectiveness of the control measures.

Some hazards might typically include:

- hygiene issues
- gangways, ladders and stairs
- moving or rotating machinery without guards
- explosive gases in a battery compartment
- slippery decks
- hot piping, such as exhausts that are not insulated.

If a risk is identified the master should be informed and crew members should assist in developing these measures. Requirements for risk assessment and safe working practices are outlined in the NSCV.

CHAPTER 4

Weather over the water

Predicting changes and future developments to weather patterns over the ocean is an invaluable, albeit complex, science that is continually conducted in Australia by the Bureau of Meteorology. The Bureau's forecasts and warnings are extremely beneficial, enabling mariners to make appropriate plans and take precautions for the expected weather conditions. However, a broad understanding of weather patterns, particularly in the area where a vessel is usually operated, is a valuable skill for crew members to have. Weather predictions should be used as a guide only and mariners should always proceed with caution, drawing from their local knowledge and experience. However, if the Bureau has predicted bad weather, mariners should take note and not risk the safety of the vessel and crew.

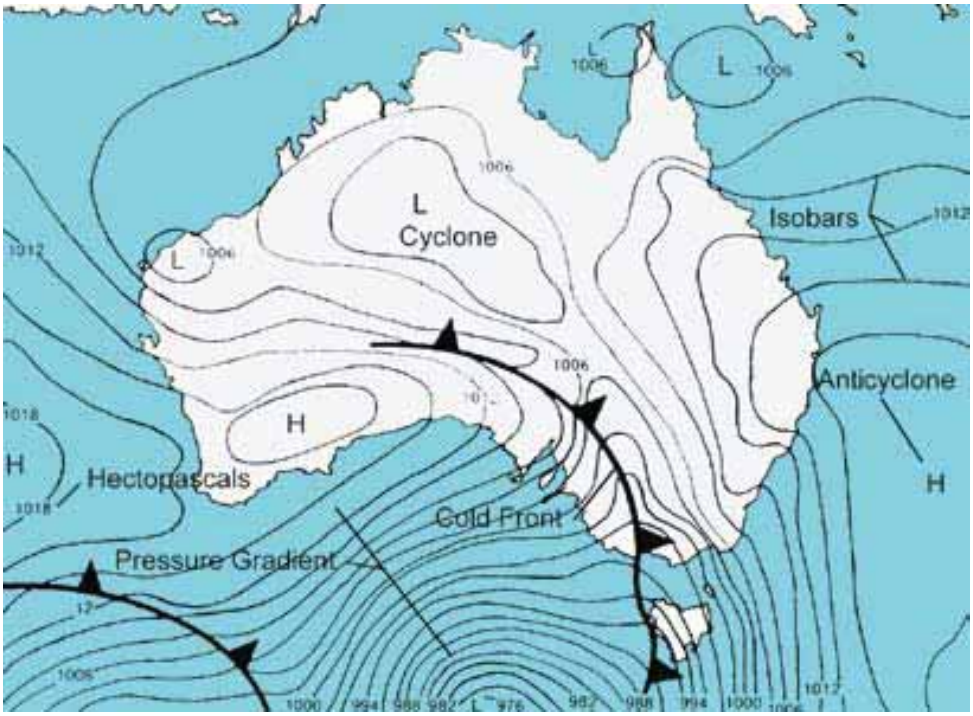
The Synoptic Chart

A synoptic chart is a map of a geographical region and represents atmospheric conditions that have been analysed or forecasted for a given time period. They are also known as weather charts, pressure charts or mean sea level pressure charts and are periodically prepared by the Bureau of Meteorology based on the latest observations (surface and satellite) around Australia.

Isobars depict the locations of the main pressure systems located in the region — isobars are the lines on the chart and join places that have equal atmospheric pressure. The arrangement of the isobars define the areas of high pressure (known as anticyclones or ridges) and low pressure (known as cyclones or troughs). When the isobars are close together, there is a strong pressure gradient and therefore stronger winds. As the lines move further apart, the pressure gradient weakens which produces lighter winds. These pressure differences are the principal causes of winds and a mariner can make useful judgements about the strength and direction of the wind following analysis of the isobar patterns.

There are two basic rules that govern wind direction in the southern hemisphere:

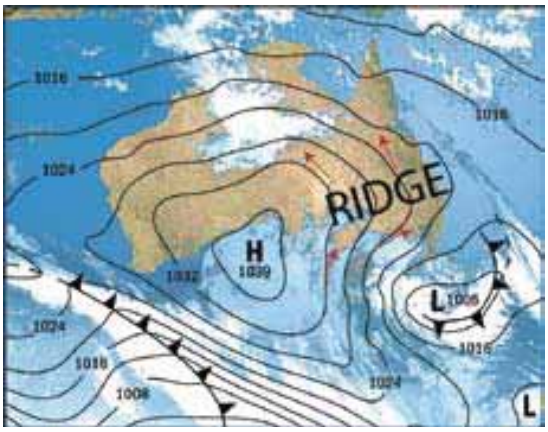
- Winds tend to flow outwards from and anticlockwise around a high pressure system (where the isobars are close together).
- Winds tend to flow into and clockwise around low pressure systems (where the isobars are further apart).



Synoptic chart

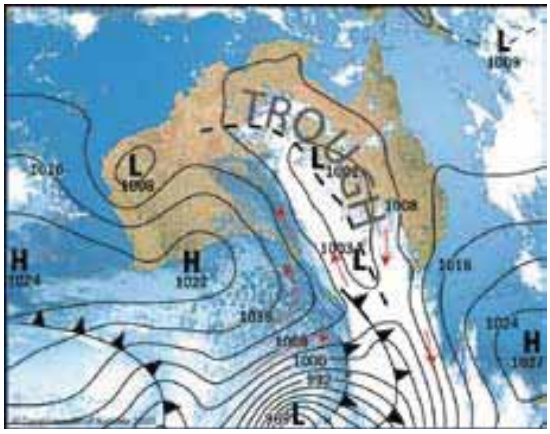
Ridges

An elongation of isobars in a high pressure system is called a ridge. In Queensland they normally extend from the southwest across inland Australia or from the southeast extending along the Queensland coast from highs in the Tasman Sea.



Troughs

Troughs are shown on the synoptic chart as dashed lines across the isobars. They indicate an area of lower pressure compared to the immediate surroundings. A change in wind direction will generally be observed as you cross from one side of the trough to the other. Troughs are usually associated with a discontinuity in the winds, showers and thunderstorms in Queensland.

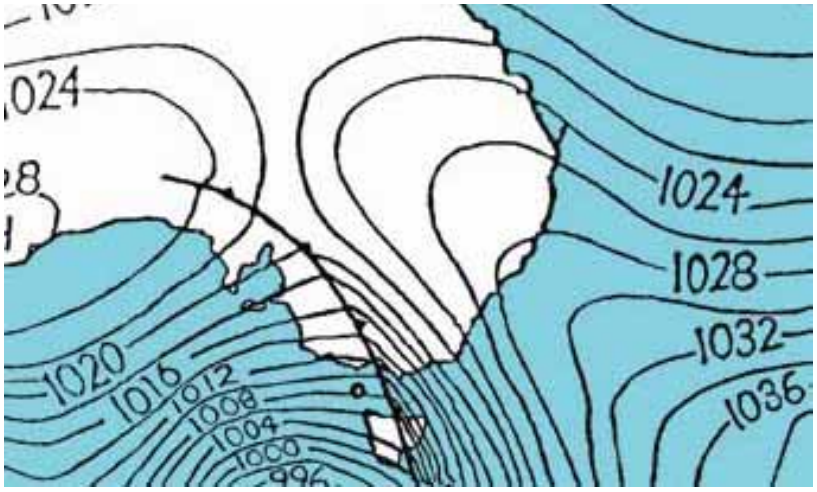


Specific weather systems

The weather systems in this section are those that are relevant to Queensland coastal and offshore waters. It is important for mariners to know these systems to understand the weather patterns on the water when making decisions regarding the safety of the ship and crew members.

Cold front

The progression of lows across southern Australia during the winter months tend to bring together two very different air masses — a relatively warm, moist air mass from over the continent or warmer waters off the east coast and a very cold and saturated air mass from over the southern ocean. As the cold air invades the warm air, a relatively narrow, often fast moving, frontal band of intense condensation and turbulence generally develops.



A cold front synoptic chart

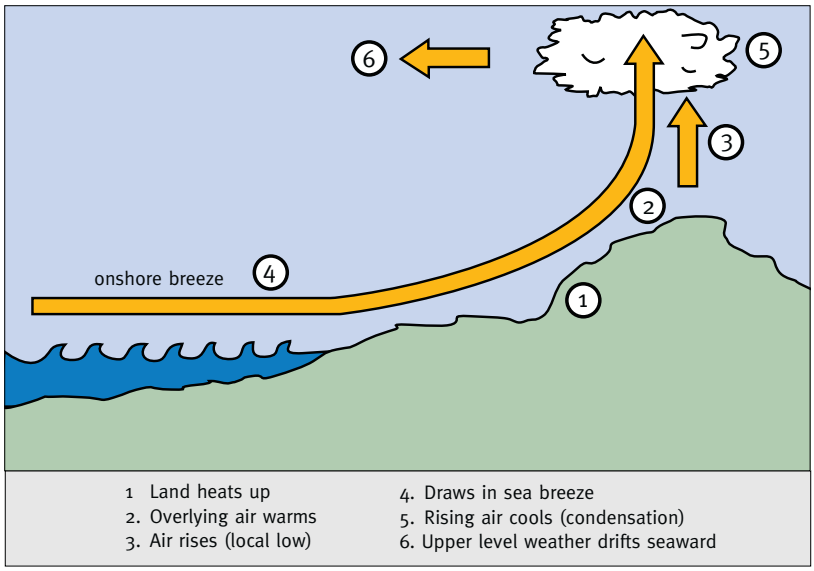
Before the cold front conditions tend to be relatively warm with winds freshening generally out of the north. A long, low, black 'roll cloud mass' often accompanies the approach of the front from the west.

A cold front

As the front passes over, conditions usually include extremely strong and gusty winds. Once the front has passed over, cold and vigorous wind out of the west/southwest may persist for a few hours.

Coastal land and sea breezes

Seawater temperatures change very slowly on a seasonal basis, whereas land temperatures rise and fall substantially in a day/night cycle. By afternoon, the air over land is heated from the warm land. This warmed air tends to rise thereby producing a localised low pressure



Onshore breeze

system that draws in the cooler air from offshore (the sea breeze). The resultant onshore breezes may be vigorous by late afternoon, particularly in the summer months.

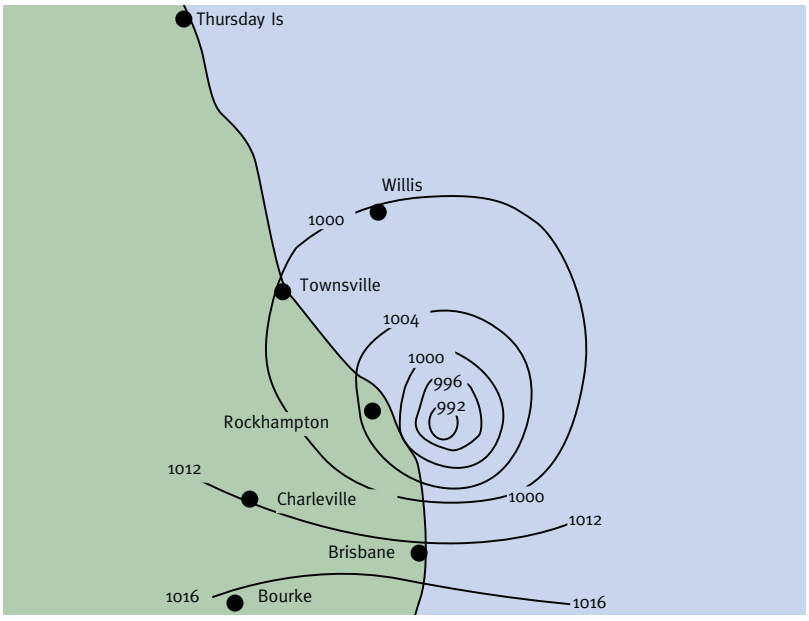
The rising air along coastal hinterlands, particularly where the higher land reinforces the uplift of air, may produce heavy cloud build-ups and possible storms that are likely to drift seaward during the late afternoon.

The coastal sea breeze effects generally occur over a narrow (15 nautical miles) band along the coast. They may affect the direction of and reinforce or counter the strength of prevailing synoptic winds.

Tropical cyclones

A cyclone is a complex low system that develops over tropical waters located near the equator. Australia's tropical cyclone season is between November and April, mostly occurring in the northern region due to the tropical climate. They are usually small but very intense and, as a direct result, may contain very high and destructive winds.

In the warm, tropical oceans cyclones are formed through a combination of high sea temperatures, high humidity and low level winds. They form as the result of a collision of



Tropical revolving storm (TRS) synoptic chart

warm and cold air. As the warm air rises, the cold air rushes in to take its place and, at the same time, a rotation is imparted to the path of cold air by the effect of the earth's rotation.

Cyclones require vast amounts of water vapour to maintain intensity and tend to decay into rain depressions over land. However, cyclones can reform if they move out over warm seas again.

In Australia, the tropical cyclone warning centre (TCWC) tracks cyclones by satellite and weather radar in an attempt to track the cyclone's potential path, which are typically erratic and therefore hard to predict. Mariners should be aware of warning signs of an advancing tropical cyclone in order to take action to avoid them. Early warning signs of a tropical cyclone include:

- a long, heavy swell radiating up to 900 nautical miles from the centre
- diurnal pressure pattern ceases
- unsteady or falling barometer
- strengthening and (probably) shifting winds.

Action to avoid cyclones

Mariners should take prepare for a cyclone by:

- Finding a safe haven — shallow mangrove creeks away from exposed winds are suitable.
- Secure hatches, clear decks, stow loose equipment and board or tape up large windows.
- Centralise weight distribution and keep heavy objects low down in the vessel.
- Check the bilge pump is operating correctly.
- If possible, remove the motor from the tender and fill it with water to prevent it being blown around in the strong winds.

The aneroid barameter

A barometer is an instrument used to measure atmospheric pressure — which is the weight of a column of air above it.

Most weather systems indicate their intensity and their probable future movement by the level and rate of change of the atmospheric pressure. Therefore, a barometer is extremely important in weather forecasting and is a necessity for vessels at sea. In general, a rising pressure indicates improving conditions. A gentle fall in pressure is nothing to be concerned about, however, a sharp drop in pressure may be a sign of worsening weather conditions.

Note: the average atmospheric pressure at sea level in Queensland is about 1013 HPa (hectopascals — a unit of measuring barometric pressure). It is higher in winter than in summer and increases away from the equator.

Tides and currents

Tide is the periodic rise and fall of the surface of the oceans, bays and so on, due principally to the gravitational interactions between the Earth and the Moon and, to a lesser extent, between the Earth and the Sun.

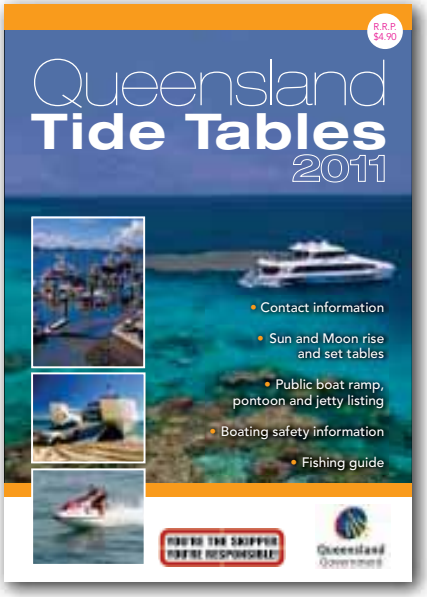
The periodic rise and fall of the tide follow a reasonably regular pattern over a 19-year cycle and therefore the height of the tide at a particular place can be predicted well into the future and with a reasonable degree of accuracy.

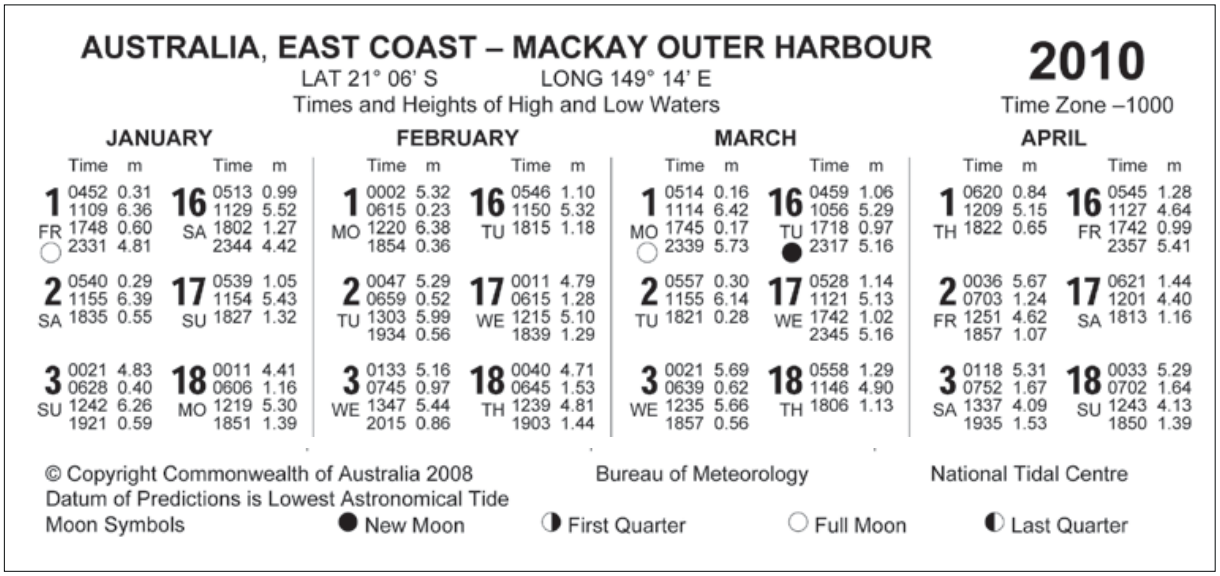
Tidal planes

The form of the tide changes as you progress north along the Queensland coast. There are two tidal planes: semidiurnal and diurnal. The term semidiurnal refers to a tide which has a period or cycle of approximately half of one tidal day (about 12.5 hours). Semidiurnal tides usually have two high and two low tides each day. The term diurnal refers to a tide which has a period or cycle of approximately one tidal day (about 25 hours). Diurnal tides usually have one high and one low tide each day.

Tide tables

Tide tables provide detailed predictions of the times and heights of high and low waters at standard ports for every day of the year. The precise position for which the predictions are made is usually given in latitude and longitude. The time zone used for the predictions is the standard time for the area and is given at the head of each page.





AUSTRALIA, EAST COAST – MACKAY OUTER HARBOUR **2010**

LAT 21° 06' S LONG 149° 14' E

Times and Heights of High and Low Waters

Time Zone –1000

JANUARY				FEBRUARY				MARCH				APRIL			
	Time	m			Time	m			Time	m			Time	m	
1 FR ○	0452	0.31	16 SA	0513	0.99	1 MO	0002	5.32	16 TU	0546	1.10	1 MO ○	0514	0.16	16 TU ●	0459	1.06
	1109	6.36		1129	5.52		0615	0.23		1150	5.32		1114	6.42		1056	5.29
	1748	0.60		1802	1.27		1220	6.38		1815	1.18		1745	0.17		1718	0.97
	2331	4.81		2344	4.42		1854	0.36					2339	5.73		2317	5.16
2 SA	0540	0.29	17 SU	0539	1.05	2 TU	0047	5.29	17 WE	0011	4.79	2 TU	0557	0.30	17 WE	0528	1.14
	1155	6.39		1154	5.43		0659	0.52		0615	1.28		1155	6.14		1121	5.13
	1835	0.55		1827	1.32		1303	5.99		1215	5.10		1821	0.28		1742	1.02
							1934	0.56		1839	1.29					2345	5.16
3 SU	0021	4.83	18 MO	0011	4.41	3 WE	0133	5.16	18 TH	0040	4.71	3 WE	0021	5.69	18 TH	0558	1.29
	0628	0.40		0606	1.16		0745	0.97		0645	1.53		0639	0.62		1146	4.90
	1242	6.26		1219	5.30		1347	5.44		1239	4.81		1235	5.66		1806	1.13
	1921	0.59		1851	1.39		2015	0.86		1903	1.44		1857	0.56			
1 TH	0620	0.84	16 FR	0545	1.28												
	1209	5.15		1127	4.64												
	1822	0.65		1742	0.99												
				2357	5.41												
2 FR	0036	5.67	17 SA	0621	1.44												
	0703	1.24		1201	4.40												
	1251	4.62		1813	1.16												
	1857	1.07															
3 SA	0118	5.31	18 SU	0033	5.29												
	0752	1.67		0702	1.64												
	1337	4.09		1243	4.13												
	1935	1.53		1850	1.39												

Bureau of Meteorology National Tidal Centre

Datum of Predictions is Lowest Astronomical Tide

Moon Symbols ● New Moon ◑ First Quarter ○ Full Moon ◐ Last Quarter

Semidiurnal tidal plane — Mackay Outer Harbour

Secondary places are those for which detailed predictions are not available. The times and heights of high and low water at secondary places are obtained by applying corrections to the predictions of a nearby standard port.

Calculating tide times for secondary ports

Find the required locality in the tide table and note its standard port.

Extract from the table semidiurnal tidal planes

place	latitude south	longitude east	time difference		height above lowest astronomical tide MHWS	MHWN	MLWN	MLWS	AHD	MSL	Ratio	Cons	HAT
			HW	LW									
standard	**27 05**	**152 07**	**standard port**		**2.16**	**1.76**	**0.75**	**0.35**	**1.243**	**1.27**	**1.00**	**0.00**	**2.71**
secondary	27 12	152 15	-0 25	-0 20	1.75	1.25	0.55	0.15		0.84	0.81	+0.04	2.35

Time of high water

1. Note the time difference in column 1.
2. Add or subtract (as indicated by + or -) this time difference to the predicted time of high water at the standard port.

Time of low water

1. Note the time difference in column 2.
2. Add or subtract (as indicated by + or -) this time difference to the predicted time of low water at the standard port.

The result is the approximate time of the tide at the required locality.

Height of high water

1. Find the height of the predicted high water at the standard port.

2. Multiply the height by the figure in column 9.
3. Add or subtract (as indicated by the + or -) the figure in column 10.

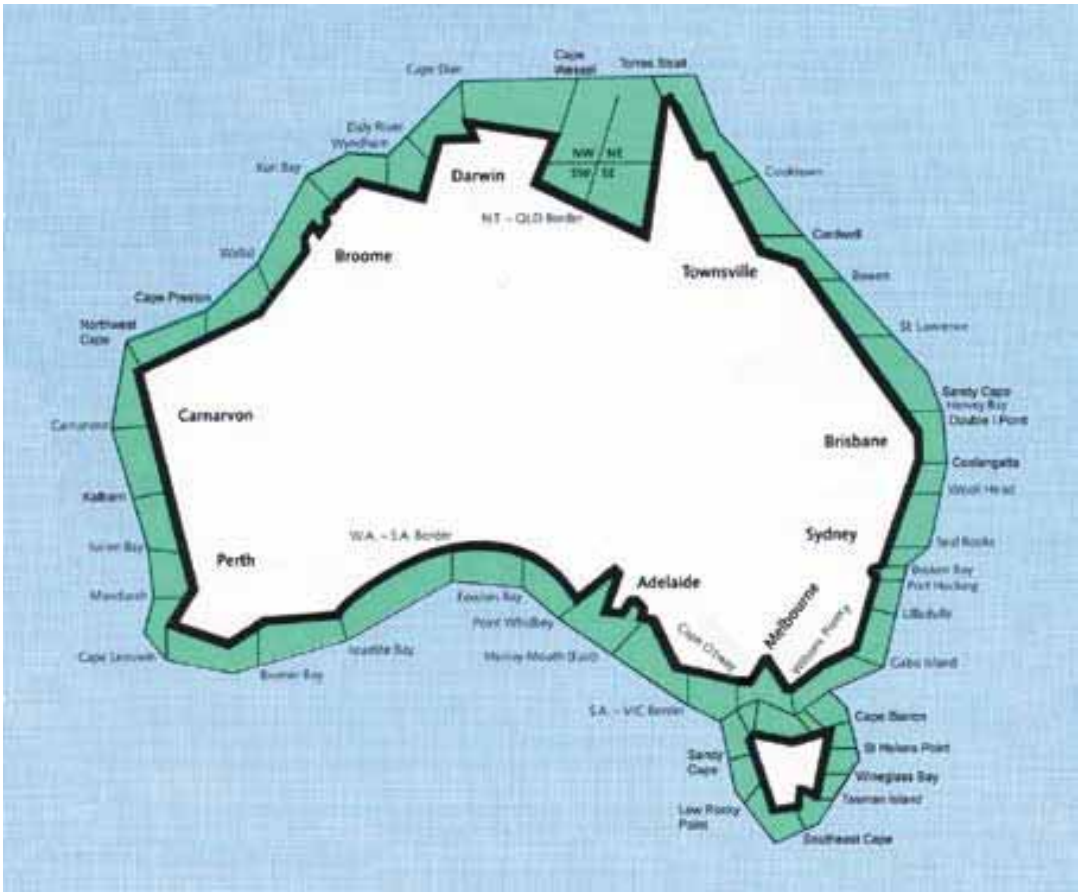
Height of low water

1. Find the height of the predicted low water at the standard port.
2. Multiply the height by the figure in column 9.
3. Add or subtract (as indicated by the + or -) the figure in column 10.

A copy of the Queensland Tide Tables should be kept on commercial vessels operating in Queensland to be used as a reference by crew members — the movement of the tide must always be considered when planning a journey.

Obtaining weather information

The Bureau of Meteorology website (www.bom.gov.au) is a very useful resource for obtaining not only weather predictions, but also weather warnings and a host of explanatory and education material.



Coastal waters forecast areas

Additionally, up-to-date weather reports can be obtained from the following sources:

- limited coast stations such as the Australian Volunteer Coast Guard and Volunteer Marine Rescue
- VHF marine radio services

- ABC and commercial AM/FM radio and television stations
- HF radio service VMC — 8176kHz
- recorded telephone maritime weather service (TWS)

  Queensland

Full state service	1900 955 360
Qld coastal waters service	1900 969 923
Qld coastal marine warnings	1300 360 427

- newspapers
- maritime safety information via Satcom C.

Remember: regardless of the predicted weather conditions, mariners must always observe the weather as conditions can change quickly and with little warning.

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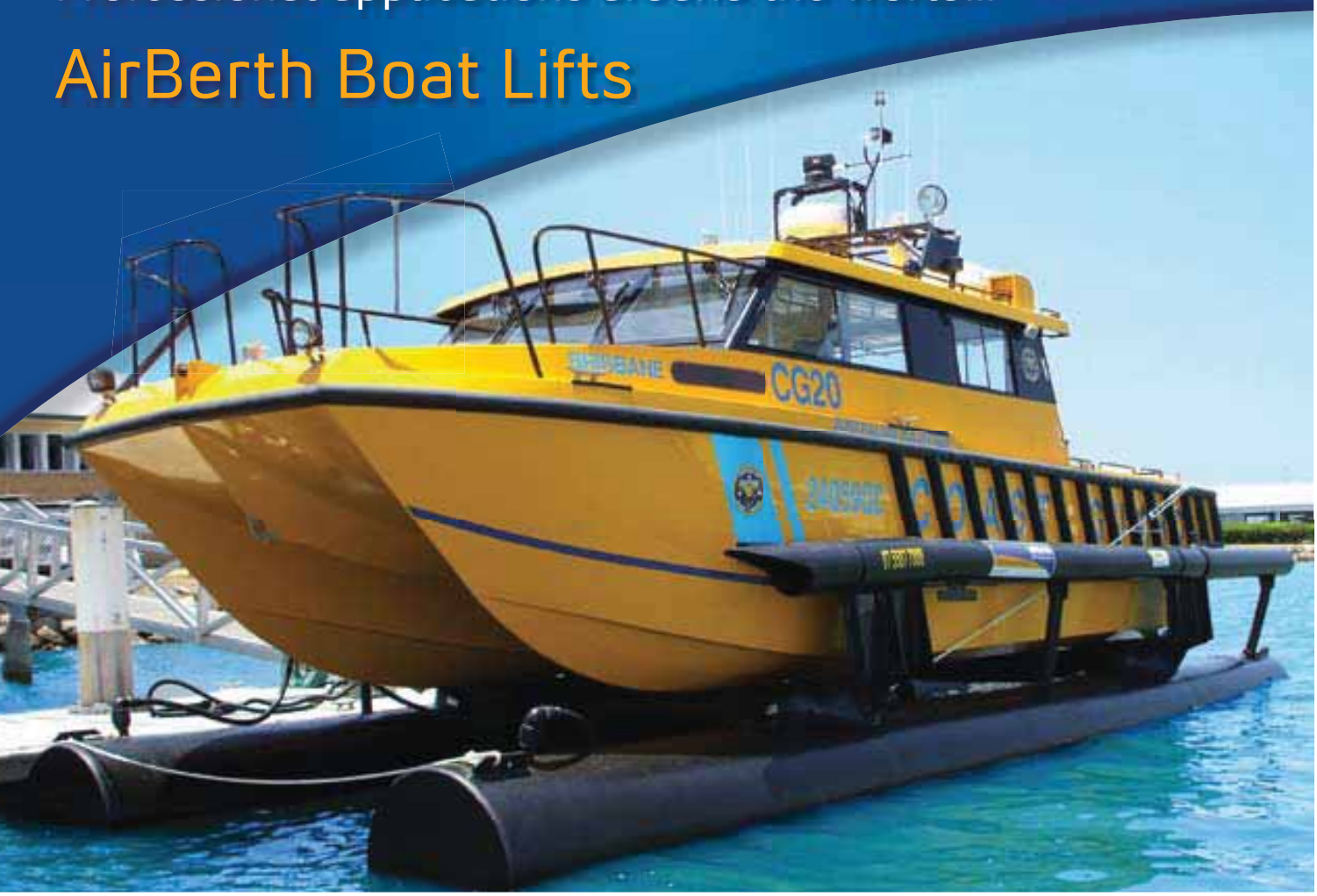

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CHAPTER 5

Seamanship

The term seamanship is a broad one. Good seamanship includes everything from keeping the heads (toilets) clean and hygienic to handling the ship professionally and safely in adverse weather.

Housekeeping and staying shipshape

Housekeeping is an essential part of good seamanship — a place for everything and everything in its place. Consider the following when working as a crew member on a vessel:

- Keep the decks clear, especially access to emergency equipment.
- Hatches that are to be closed at sea should remain that way.
- Keep freeing ports clear at all times.
- Tidy all loose lines on deck.
- Fish/slime should be washed from the deck frequently.
- Always keep personal equipment stowed if it is not in use.

Types of ropes

Natural fibre

Natural fibre ropes are not as common as they used to be due to the superior strength offered by modern synthetic lines. However, they are still used for slings, cargo nets and lines that are run through block and tackles. Two types of natural fibres are:

- Manila — the strongest natural fibre, it is made from a type of banana tree found in the Philippines.
- Sisal — this fibre comes from a plant cultivated in Africa.

These ropes are relatively easy to knot and splice and are easy on the hands. Their lack of strength, when compared to synthetic lines, is due to the fibres that make up their construction not being continuous – plants only grow so tall.

Synthetic fibre

The fibres that make up the construction of synthetic rope are sometimes as long as the rope

itself, due to the plastic extrusion process. Plastics technology is complex and many different types of synthetic ropes exist today. The most common synthetic fibre ropes used onboard include:

- Nylon (polyamide) — it is immensely strong and may stretch up to 42% before breaking. For this reason it is ideal for situations where shock loads may be incurred, such as safety lines.
- Polyester — this is next in strength to nylon and stretches to about 35% before breaking.
- Silver rope (polyethylene) — very common onboard and often used for dinghy painters as, unlike polyester and nylon, it floats and rarely fouls propellers. It has good abrasion resistance and is relatively easy to knot and splice.

Steel wire rope

Used almost exclusively for lifting operations, steel wire rope comes in many different forms of construction and material. It is very important that the right type of wire is used for the right application. For example, wire rope that may be suitable for bracing a mast will be unsuitable for running through a block and tackle.

Chain

There are three standard grades of chain: 30(L), 40(P) and 80(T). Grade P is commonly used for anchoring and the much stronger Grade T is used for lifting purposes. Chain may be long link or the stronger short link. Stud link chain is even stronger as the studs strengthen the links and prevent distortion. The studs also prevent the chain from forming kinks or knots.

Chain should be joined using special lugged shackles, rather than conventional shackles. Using bolts to join chains should be avoided. If a conventional shackle is used, ensure its safe working load is equal to or greater than that of the chain. 'Proof tested chain' should be stamped on every link with the grade identifying letter.

Generally chains must be regularly inspected for wear, rusting and distortion and defective chains not used until they have been properly repaired.

Working load limits (WLL)

The working load limit is the maximum load which should be applied to an object under any condition. The WWL is based on a load being uniformly applied in a straight line pull. How the load is slung will affect the WLL.

Lifting gear

All lifting gear onboard is subject to extreme conditions and must be treated with care. This gear includes derricks, cranes, booms, rigging gear (blocks and tackles) and fish-lifting equipment. It also includes portable components such as eyes, shackles, hooks and pulley blocks.

Lifting gear should be regularly maintained and certified by an appropriate authority.

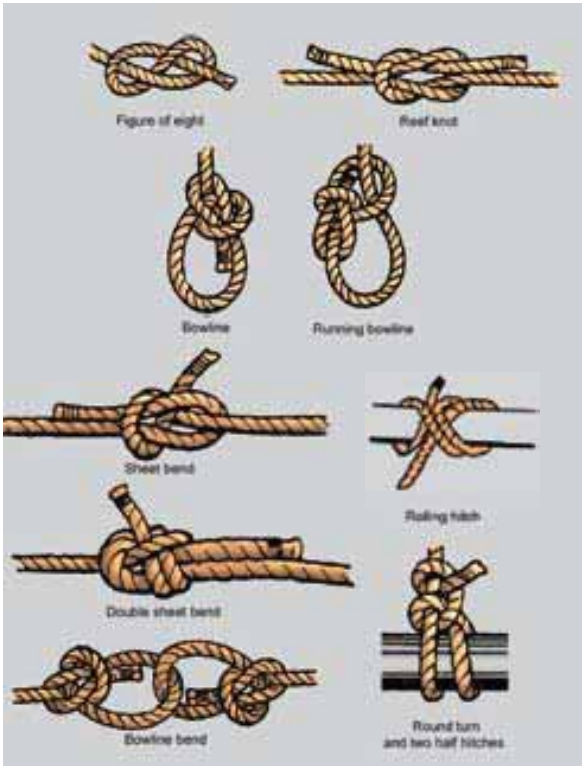
The following inspections should be carried out on lifting equipment:

- Check that the WLL is appropriate for the job.
- Check the eyes or chain links have not elongated.
- Check shackles are 'moused' (pins secured) and not worn.
- Sheaves of blocks are rotating and not worn.
- Check that steel wire rope is not rusted or kinked and has no broken strands.
- Keep moving parts well lubricated.
- Paint for protection where appropriate.
- Record all maintenance carried out.

When operating the equipment:

- Have a communication system — make sure all personnel involved know the correct signals.
- Make all movements slow and gradual.
- Be aware of the possible effect of the movement of the vessel in a seaway.
- Avoid sudden shocks and beware of 'side pulls'.
- Consider the effects that loads may have on the stability of the ship.
- When using derricks or cranes remember that the centre of gravity of a suspended load acts from the end of the boom.
- Don't stand in the bight of a line in case the line snaps under load.
- Never walk or stand under a suspended load.
- Always wear personal protective equipment and clothing.

Knots, hitches and bends



The ability to work a single line into a shape to perform a function (a knot), attach a line to an object (a hitch) or join two lines together effectively (a bend) are essential skills for crew members to learn. A good reference book will help crew to become proficient in rope work and there are many publications available on the subject.

Listed below are the basic knots, hitches and bends that crew members should be proficient in — like any skill it takes practice.

Reef knot

This knot is used to reef sails — tie them down to the boom to reduce the sail area in high winds. These reefing lines are single lines, so they are known as a knot rather than a bend. Lines of the same diameter must be used to tie a reef knot.

Figure-of-eight knot

This knot can be used in two ways:

- to stop a line from running through a block or fairlead
- as a hand hold to make it easier to grip the line.

Bowline (pronounced 'bowlin')

One of the most useful knots onboard a vessel, it forms a temporary eye in the end of a line and, even after a heavy load has been applied to it, will undo easily by 'breaking its back'. A bowline reduces the strength of the line by 50%.

Sheet bend

A sheet bend is identical to a bowline, but they are both used for different function. One line is passed through a loop of another line, rather than tied in itself, therefore, it is a bend rather than a knot. A sheet bend can be tied with two lines of different sizes but the strength of the lines in this bend will be reduced by 25%.

Clove hitch

A line can be very quickly tied to a rail using this hitch. However, it mustn't be used for suspending heavy weights as it is prone to slip on some surfaces, such as stainless steel rails.

Rolling hitch

The rolling hitch is used to take strain along spar or large rope, chain or wire. Instead of one initial turn about the spar, take two turns on the side the pull is to be exerted. The gripping power may be doubled by tying the hitch twice on the rail.

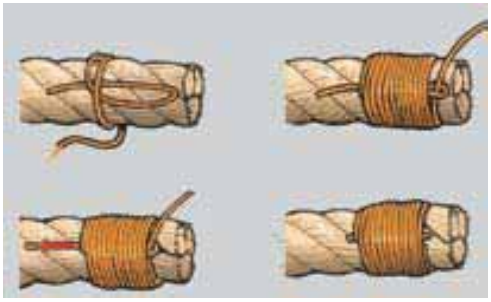
Round turn and two half hitches

Common for securing line to a bollard, spar or ring.

Whipping

Ends of a rope should be protected from unravelling by whipping. There are several methods, but one of the easiest to do is traditional whipping.

When whipping the end of a rope ensure that the turns of the whipping are passed against the lay as illustrated here. These turns need to be made as tightly as possible.



A common whipping.

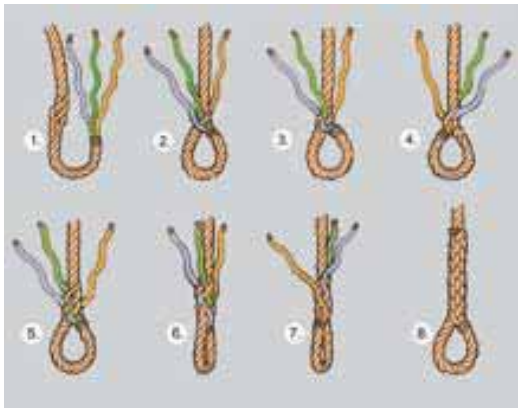
Special whipping twine that has a wax coating is available from ship chandlers. This helps the twine slip against itself and the rope to make sure that a tight bind is achieved. The width of the whipping should be equal to the diameter of the rope.

Melting a synthetic rope end

Commonly known as a butane backsplice, this is a common practice to prevent unravelling of a synthetic rope. Using an electric hot knife designed for the purpose is by far the most effective and safest way to do this, however, a whipping should still be applied.

Splicing three strand rope

Splicing is a preferred method of forming an eye in a rope (or joining two ropes together) as it does not weaken it as much as a knot does. A well-executed splice may retain 90% of the rope's strength, compared to approximately 50% for some knots and bends. Knots, are temporary arrangements, whereas a splice is permanent because it involves deconstructing the rope into its component strands.



Eye splice.

The eye splice is the most commonly used splice onboard. Note that before unlaying the strands, a small whipping is applied to each strand to prevent them from unravelling too far. The most common mistake that is made is tucking the strands with lay of the rope. Remember, all three strands must be tucked against the lay. Notice in the above illustration that the third strand needs to be turned back against its natural direction to ensure all three are then travelling in the same manner.

When splicing natural fibre ropes, each strand should be tucked at least three times into the standing part of the line. With synthetic rope, tuck each strand at least five times.

Many publications are available on the subject of rope work.

Coiling and stowage of rope

Most lines that are used onboard, including steel wire rope, are constructed with strands that spiral in a right-hand direction. That means that as you look at the line, it spirals clockwise no matter which way you view it. For this reason, lines should be coiled clockwise. Rarely, you may encounter a left-handed lay, so always check before coiling and stowing a new line.

If the rope is coiled against its natural lay, it will be prone to kinks and twists as it runs out which may cause the line to jam in blocks or fairleads and reduce its breaking strain.

Ropes should be stored clear on a pallet or hung in their coil in a dry, well-ventilated space out of the sun.

Securing a line

To a horn cleat or small bollard: pass the line around the base of the cleat with one round turn, then follow up with figure eights around the horns of the cleat. With materials such as stainless steel and synthetic fibres, it may be necessary to finish off with a half hitch to prevent the line slipping.

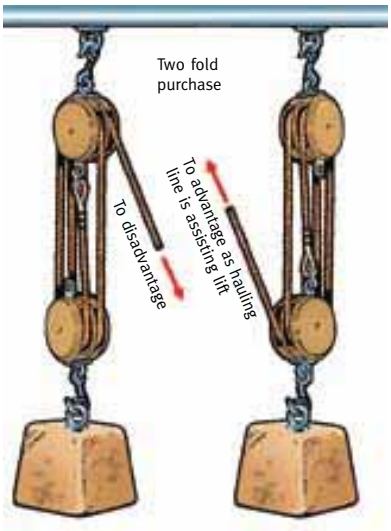
To a sampson post: pass the line three or four times around the post, then secure with a tugboat hitch (also known as a lighterman's hitch) as shown.

Anti-chafe

Some lines onboard may experience chafe and point loading over time. For example, a mooring line where it contacts the fairlead of the vessel or a towline at the point where it passes over the transom. 'Freshening the nip' is one method used to minimise this. The line is either bought in or veered out by small amounts at regular intervals. Commonly, anti-chafe material will be fixed to a line that is in continual contact with a surface.

Purchases and tackles

With the use of blocks, great mechanical advantages may be gained when heavy loads need to be controlled or moved. Most small ships will have a handy-billy in the bosun's locker — a portable block and tackle system that may be used about the ship when required. Purchases may also be a permanent part of the ship's rigging, such as the lifting mechanism for the boom of a derrick.



The tackle on the left is rove to 'disadvantage' with a mechanical advantage of 4 :1.

The tackle on the right is rove to 'advantage' with a mechanical advantage of 5 : 1.

The greater the number of sheaves in each block, the greater the mechanical advantage and the more weight that can be moved. By counting the number of lines (falls) supporting the moving block, the mechanical advantage can be determined.

Blocks must be well maintained and, if used for lifting, must have their safe working load stamped on the cheeks.

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Anchors and anchoring

Anchors are used primarily to hold vessels in one place, but are also able to reduce the rate of drift in heavy currents or seas and assist in berthing in close quarters.

Glossary of anchoring terms

Anchor aweigh — the anchor is aweigh immediately if it is broken out of the ground.

Bitter end — the very end of the anchor cable, where it is attached to the ship. When at the bitter end, there is no more cable to let out.

Catenary — the curve formed by a uniform chain hanging freely from two points not in one vertical line.

Dragging — when the anchor is not holding the bottom it is dragging.

Freshen the nip — at intervals, especially in foul weather, veer a little more cable so that the same section of cable will not receive the punishment (chafing) all the time. The same action would apply to anchor rope in a fairlead.

Fouled anchor — anchor has fouled on an obstruction.

Hawse pipe — these are cast steel pipes near the bow of a vessel, between upper deck or forecastle and the vessel's side through which a cable passes and into which the shank of an anchor may be drawn.

Kedging — moving a vessel by means of small anchors and hawsers.

Rode — the anchor line or cable between the attachment on the vessel and the anchor.

Scope — the ratio of the cable out to the depth of water when vessel rides at anchor.

Short or long stay — the cable is at short stay if it leads steeply downwards from the hawse pipe and at long stay if it leads well away and less steeply.

Surge — to let the cable run out without using power.

Veer — to use power in paying out the cable and not to let it run free.

Windlass — a mechanism for controlling an anchor rode as it is let out or hauled in.

Weigh anchor — to heave in cable until the anchor is broken out of the ground and clear of the water.

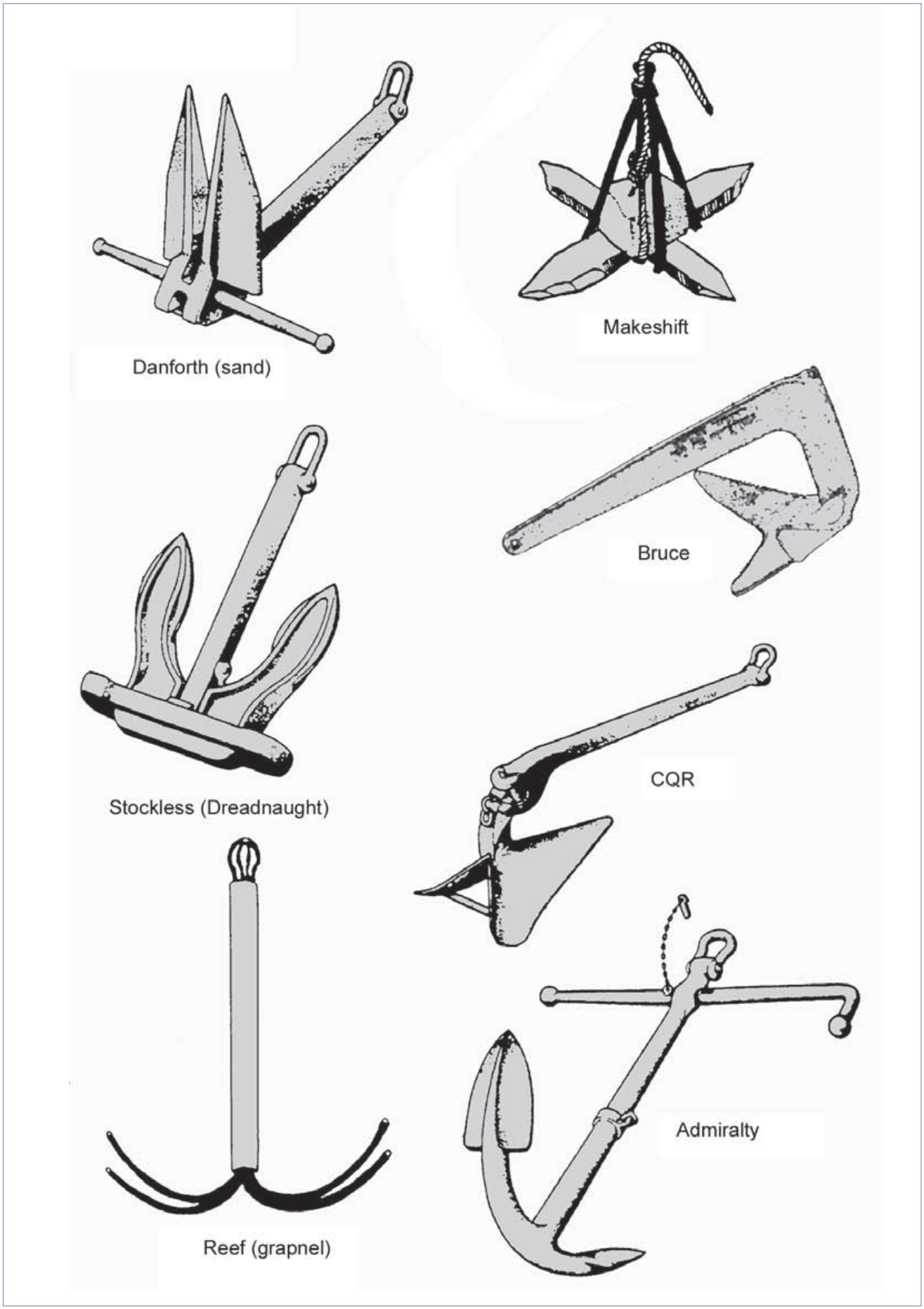
Types of anchors

The NSCV, Part C Section 7 deals with the number and weights of anchors required on various sizes and types of commercial vessels. However, anchors come in many shapes and sizes.

All of the anchors on the opposite page, with the exception of the reef grapnel, operate using the same principle. The flukes of the anchor will dig into the sea bed just like a plough. There are some advantages and disadvantages with each design, like stowage onboard and holding power in different bottom compositions.

For example, the danforth anchor design is commonly seen aboard small ships. It is relatively lightweight, may be stowed into a hawse pipe and holds well in muddy or sandy bottoms. However, the danforth also tends to need a higher scope ratio as it does not hold well at

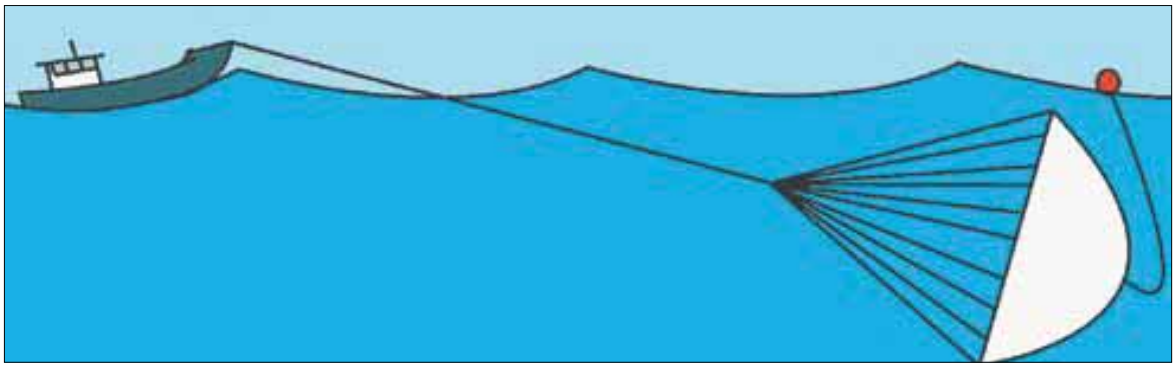
short stay, it tends to break out if strain is exerted from a sightly different direction and is also subject to fouling the rode if care is not taken.



Sea anchor

Also known as a drogue, this piece of equipment does not secure the vessel to the sea bed in any way. It is primarily used to slow the rate of drift of the ship at times when traditional anchoring is not possible, such as in very deep water.

In effect, the sea anchor is simply a hydraulic parachute. It can be deployed when a diver needs to disentangle a propeller far out at sea, to slow the rate of drift of the ship and also hold the bows toward the sea without using propulsion. On the other hand, it may be deployed during extreme conditions as a method of heaving to.

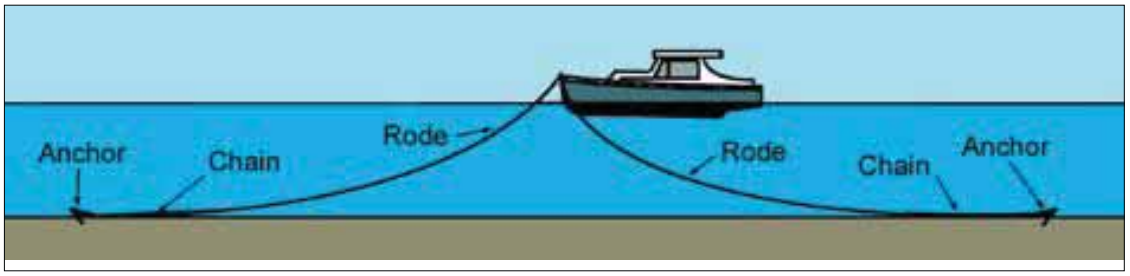


Sea anchor.

Dropping anchor

The master will take many things into account before the order is given to bring the ship to anchor. The master will consider:

- The state of the tide — under keel clearance must be adequate at all states of the tide, so when anchoring at the top of the tide, this is particularly important.
- The nature and contour of the bottom — does it drop away sharply? Does the chart indicate any smooth rock or coral heads?
- The current and forecast weather — the ship should never be exposed to a lee shore.
- The presence of hazards, nearby channels and other vessels with regard to the scope required and subsequent swinging room.



Anchoring system – scope is the ratio between the depth of water the length of the rode. For chain, a scope of 5:1 is adequate in normal conditions; increase to at least 7:1 if conditions worsen.

During the manoeuvre, crew members must be aware of their personal safety at all times by wearing appropriate PPE, particularly if the rode is surged rather than veered out.

- Make sure adequate communication is established with the master and that crew members have been briefed on any other crucial matters such as how much cable to pay out. Crew members must be familiar with the markings on the chain.

- Crew members must be familiar with the operation of the anchor windlass. Controls should be clearly marked. If they are not, the master will give a briefing beforehand.
- Ensure that the chain has flaked adequately in its locker or is arranged on deck so that no kinks or twists will prevent the rode from running free. Also ensure that the bitter end is secured to the vessel.
- As the anchor comes to rest on the bottom the ship should have slight sternway. If it does not, the rode is likely to foul the anchor. The rode should be laid out neatly behind the anchor so it does not catch on the flukes or stock.
- When the required scope is reached, apply the brake to the windlass and communicate this to the master. The master may then set the anchor using moderate reverse propulsion.
- Any raising or dipping of the rode at this stage may indicate that the anchor has not set but is dragging.
- Anchor windlasses are designed to raise and lower the ground tackle – not as a strong point to secure the vessel. The strain should be taken off the windlass and transferred to a sampson post on the foredeck, using a snubber line with a devils claw. This is known as a chain stopper.
- Observe the vessel's position with regard to other vessels, landmarks or transits and always remain vigilant for a dragging anchor.

Dropping anchor is a controlled exercise at all times and a well-executed manoeuvre as a result of good communication between crew members and the master. However, vigilance is required at all times, particularly if the weather deteriorates.

Weighing anchor

Often, it will be a crew member who calls the shots when weighing anchor. How the cable grows from the hawse pipe is not visible from the helm so good communication is essential. The master's actions with throttle and helm will often be dictated by the hand signals received from the crew members on the foredeck.

The windlass must not be used to bring the ship to short stay without the ship's main propulsion being used — remember the windlass is not a strongpoint. Substantial damage can occur if this piece of deck machinery is used to haul the entire ship through the water. Instead, the ship should be motored gently along the lay of the cable as the windlass brings it aboard.

Some points to remember when weighing anchor

- The cable may need flaking in the anchor locker below as it comes aboard. This prevents it mounting up under the spurling pipe as well as ensuring a clean run out the next time the vessel is anchored.
- Observe the chain links as they engage in the gypsy. A worn gypsy or elongated chain links will result in a jam and a dangerous override will result. If this occurs, veer some cable back out. If the cable is surged, it may jump off the gypsy completely and continue running out until the bitter end is reached.
- Some windlasses are fitted with a chain stripper which is a piece of metal mounted edge-on at the base of the gypsy to ensure any jammed links are prised out and don't cause an override.

- Have a well-understood set of signals to communicate with the helmsman. These should include the amount of chain that has come aboard, how the cable grows, when the cable is up and down, and when the anchor is hove in sight.
- Ensure that a chain stopper (such as a devils claw) is applied to the chain once the anchor is home. Do not rely on the windlass brake alone to hold the anchor in place.
- Changing the scope of the anchor rode (either more or less) does not reduce swinging, but only changes the 'period' of the swing. A smaller scope will result in a faster cycle, and increase the chance of anchor failure. The laying of two anchors set 45 degrees apart and centred on the wind will prevent swinging, but is not always a feasible option.

Motions of an anchored vessel

A vessel at anchor is constantly exhibiting many forms of motion. These are:

- Pitching — just as a vessel pitches underway, it will pitch at anchor if waves are present and of adequate size. The effect this has on the anchor cable is called heaving.
- Surging — as the wind gusts or the tidal stream varies in strength, the ship will surge on its anchor so that the cartenary of the cable will alternately decrease and increase.
- Sway and yaw — commonly referred to as swinging, this is the more obvious motion to be aware of. It occurs because the centre of wind and wave pressures act forward of the centre of lateral resistance of the ship. This tends to be more extreme on high-bowed vessels with their superstructure located forward of the beam. A vessel may sheer more than 60 degrees from the wind direction.

Watchkeeping at anchor

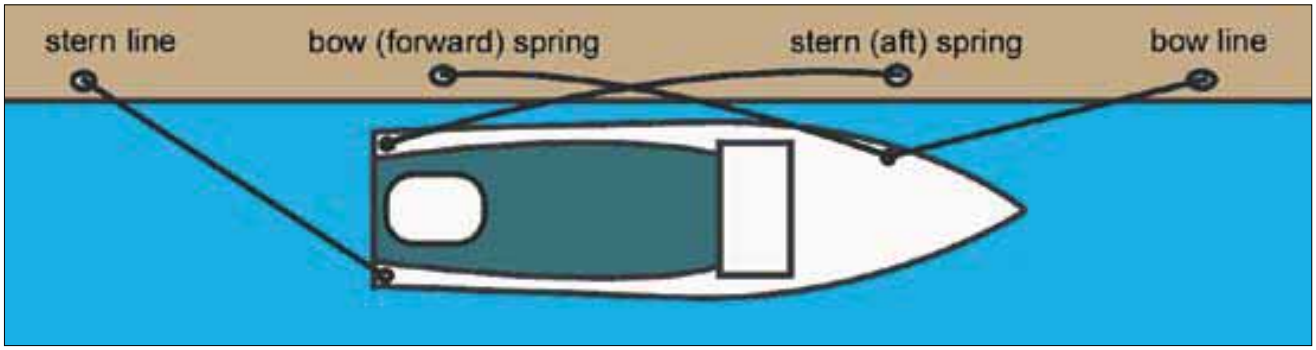
It is important for crew members to ensure that a proper lookout is maintained while the vessel is at anchor. The watchkeeper should:

- at suffienctly frequent intervals, check whether the vessel is remaining securely at anchor by taking bearings or observing transits of identifiable shore objects
- monitor weather, tide and sea-state conditions
- advise the master and take necessary measures if the anchor drags
- advise the master if visibility deteriorates
- ensure proper lights, shapes and sound signals are exhibited.

Coming alongside

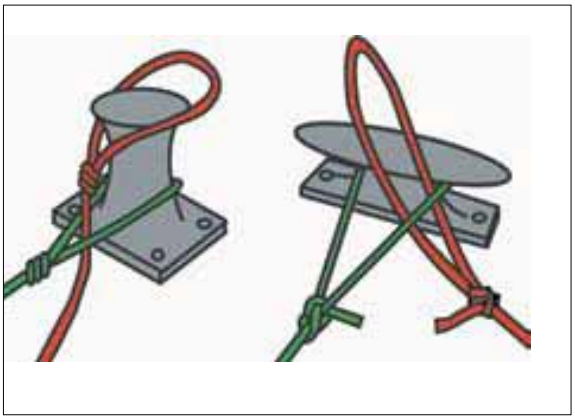
As with anchoring, good communication between crew and the master will ensure this manoeuvre is carried out safely and efficiently. It is important for crew members to know the correct terminology to maintain successful communication between the crew and master and avoid confusion.

How the berth is approached and the order in which berthing lines are to be passed ashore is entirely dependant on the master and may change with different circumstances and vessels. However some general rules for crew members will apply at all times.



Note: the forward spring line is made fast to the forward part of the ship. Spring lines are often mixed up by some deck hands. In addition to the above berthing lines, breast lines may also be used. These travel directly from the bow and stern of the vessel to the wharf at virtually right angles, but must be closely monitored in tidal situations and non-floating wharves.

- Fenders will always be required. Make sure that these, as well as all berthing lines, are ready before they are needed. A smooth berthing depends largely on preparation and any last minute running around just as the vessel is approaching the wharf will not help the master concentrate on the task at hand.
- Don't leave the ship — a professional crew should be able to berth their vessel without leaving the deck to complete the task on the wharf. Ideally, someone will be on the wharf to pass a line to or a competent deckhand can throw a line with sufficient accuracy that the bollard on the wharf can be lassoed. Make sure the working ends of all berthing lines remain onboard.
- If any mooring line drops into the water, retrieve it as soon as possible so that it does not foul the propeller.
- Do not stand in the bight of a line.
- Flake the line as part of your preparations — it will allow the line to run out more easily.
- Stand out of the way of the master's line of vision as the wharf is approached.
- The master will brief the crew prior to coming alongside.
- The master's directions must be obeyed, rather than those who may be on the wharf, unless the master advises otherwise.
- Be sure to dip the eye, as illustrated. This ensures that any line can be removed from the bollard or cleat in any order and is good etiquette with neighbouring vessels that may also be sharing that bollard.



Dipping the eye.

Heavy weather

Full responsibility for the safe navigation of the ship through rough weather lies completely with the master. However, the performance of the crew at this time is also of paramount importance.

They must be well rested, well fed and appropriately clothed for the forecasted conditions. The master's decisions will be made largely on the belief that the crew are trained and able to carry out the tasks that may be assigned to them. In preparation for, or when

encountering unexpectedly bad conditions, a good crew member can show initiative by:

- ensuring that objects that may move about are securely stowed
- bring stray lines under control and maintain a clear deck
- close and secure all hatches and monitor the state of watertight and weathertight integrity of the ship by closing portholes and deadlights and clearing scuppers, limber drainage holes and freeing ports
- secure the galley and shut off the gas supply at the bottles
- pump the bilges and ensure they are clear of debris
- be available — when off watch stay prepared by remaining clothed and having equipment readily available
- do not go out on deck without informing the master of your intensions, stay indoors and in communication with the master and fellow crew members
- prior to working on the deck put on a life jacket.

The master's options

In very heavy weather, the master may decide to run before the seas rather than continue on into a pounding head sea. During this turning manoeuvre, the vessel may roll violently as the seas come onto the beam and any gear that is not adequately secured will move from its correct location of stowage.

After the vessel is settled on its new course the wind and seas may appear to ease, as does the motion of the vessel, however great care still needs to be taken.

Broaching

In certain conditions, a vessel may be prone to broach when running before the seas. This occurs when the vessel starts to surf down the forward slope of a wave and the effect of the rudder diminishes as the stern rises and the bow drops deeper into the water. This brings the centre of lateral resistance of the underwater surface of the hull further forward, to the point where the vessel may trip over itself and yaw wildly out of control and lie broadside on the face of the wave. If the wave breaks at this point, it may capsize the vessel.

Broaching.

Pooping

When running before seas that are high and occasionally breaking, there is a possibility that a wave may actually break right over the stern of the ship and sweep the deck clear. (The term pooping comes from the days when older ships had a raised deck aft called the poop deck.)

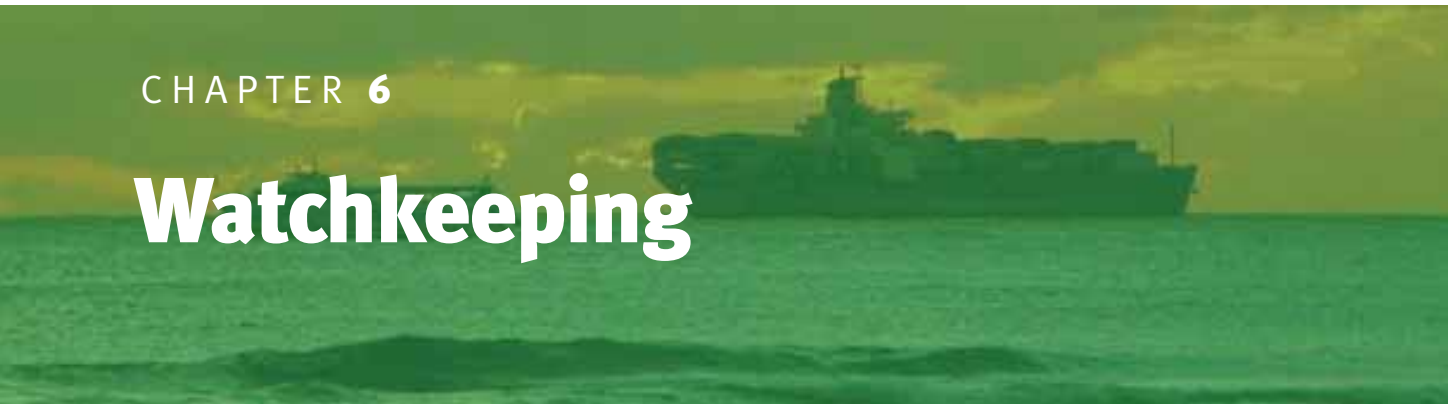
If a vessel is pooping flooding may occur as water enters open hatches, the vessel may lose stability as water enters the deck and crew members may be injured or lost overboard from the force of the breaking wave.

In extreme conditions the master may decide that the ship's operations and current course become secondary to the need for comfort of the crew and safety of the ship, and so the ship may be hove to instead (note that 'heaving to' refers to the manoeuvre itself).

Several methods exist to make the ship as safe and comfortable as possible when it is in extreme conditions. Much depends on the design of the vessel, the experience of the master, the state of the wind and sea and how much sea room is actually available with respect to the rate of drift of the ship when hove to.

A sea anchor may be deployed from the stern or the bows of the ship with the engines stopped or at least out of gear. Some ships may lie more comfortably stern to. More commonly, a power vessel may be driven slow ahead at an angle of about 15 degrees to the oncoming waves at the minimum speed possible to maintain steerage way.

Pooping.



CHAPTER 6

Watchkeeping

Standards and principles of watchkeeping

Most incidents at sea are caused by human error. In many of these incidents the standard of watchkeeping was not satisfactory or the watchkeeper was not competent. As discussed in chapter one, a watchkeeper suffering fatigue is far more likely to make an error of judgement than one who is well rested and alert.

When the master is not present at the bridge or wheelhouse the crew members are responsible for the safe navigation of the vessel and avoidance of collision or grounding.

The bridge/wheelhouse

This is the control centre of a vessel and a proper lookout must be maintained at all times from here. Extra lookouts should be posted.

The person at the helm should not be considered a lookout except in smaller vessels with an unobstructed all-round view from this position, and their night vision must not be impaired.

Duties of the watchkeeper

The duties of the watchkeeper fall into three fundamental categories:

1. Maintain a proper lookout at all times using all means available. No other duties should be assigned that could interfere with this task.
2. Ensure safe navigation by regularly checking of the vessel's position, course, speed and the identification of any potential navigational hazards such as shoals or reefs. The vessel's navigational details must be recorded in the official log book.
3. Collision avoidance by monitoring the movements of other surrounding vessels, use of the radar, the display of appropriate lights and shapes and a thorough knowledge of the collision regulations.

When to call the master

The watchkeeper shouldn't hesitate to approach the master if in any doubt about what action should be taken.

Some circumstances may include, but are not limited to:

- restricted visibility is encountered or expected
- traffic conditions are causing concern
- difficulty is experienced in maintaining the course
- navigational marks, lights or landmarks are not sighted when expected
- breakdowns of essential equipment occurs
- navigational hazards are met
- changed weather conditions threaten the safety of the ship.

Notifying the master is a requirement if the watchkeeper is in doubt, but the watchkeeper shouldn't hesitate to take any action necessary for the safety of the ship. Even if the master is on the bridge, this does not relieve the watchkeeper of their duties until specifically informed that the master has assumed control.

The collision regulations

The *International Regulations for Preventing Collisions at Sea, 1972* (generally referred to as the 'Colregs') is an International Maritime Organization convention that has been adopted worldwide as the 'rules of the road' on the water.

It is the duty of anyone in charge of a vessel to be able to correctly apply the Colregs in all circumstances in the interest of their own safety and the safety of other vessels using the seaway.

A copy of the Colregs should be kept on the bridge of the vessel at all times. Detailed below are some of the rules that crew members need to be aware of when participating in watchkeeping duties on the vessel.

Note: to provide a ready reference and to avoid ambiguity that could arise, the Regulations are printed ad verbatim. In addition, a brief overview has been included to briefly outline the meaning of each Rule. It is important that these Rules are studied until a good working knowledge is obtained.

Rule 2 — Responsibility

a) Nothing in these Rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to comply with these Rules or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

b) In construing and complying with these rules, due regard shall be had to all dangers of navigation and collision and to any special circumstances, including the limitations of the vessels involved, which may make a departure from these Rules necessary to avoid immediate danger.

- This Rule makes allowance for vessels to depart from the Rules in general in order to avoid collision. In the event of a collision, responsibility may still lie partly with the stand on vessel if an avoiding action could have been taken that is outside of the parameters of these Rules.

Rule 5 — Lookout

Every vessel shall at all times maintain a proper lookout by sight and hearing, as well as by all available means appropriate in the prevailing circumstances and conditions, so as to make a full appraisal of the situation and of the risk of collision.

This rule is fundamental to watchkeeping principles and practice and reinforces that the bridge is never be left unattended.

- Keep a 360 degree lookout — not just in front and either side of the ship.
- Use every aid available such as radar, if the vessel is fitted with one.
- Post extra lookouts if visibility deteriorates or traffic density increases.

Rule 6 — Safe Speed

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

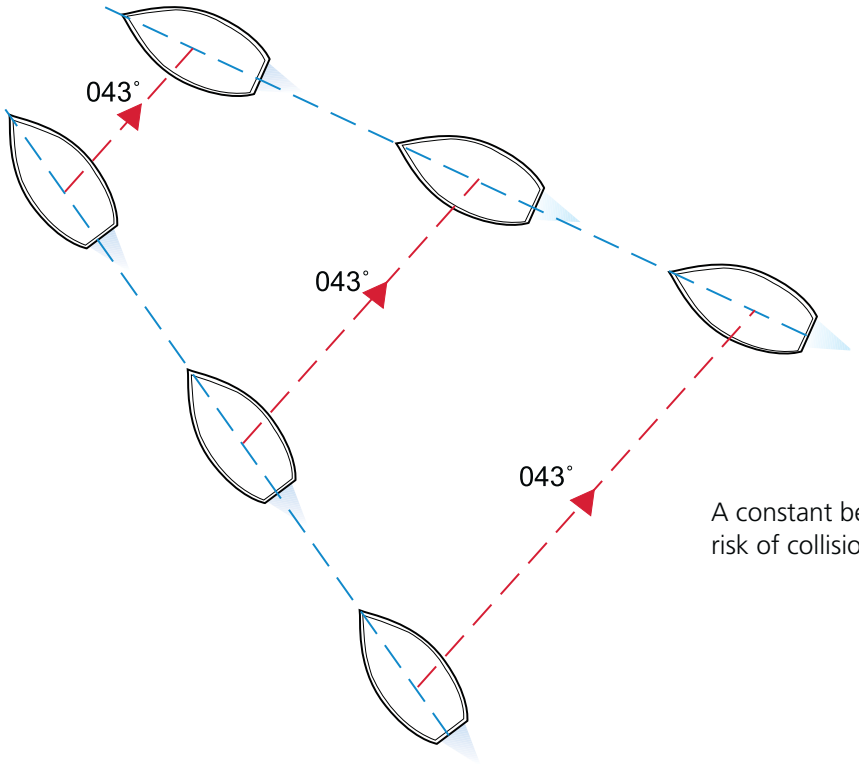
- Be aware of the state of visibility, density of traffic, the manoeuvring characteristics of the vessel, the presence of background lights at night, the sea and water conditions at the time and the ship's draft in relation to the available water when determining safe speed.

Rule 7 — Risk of Collision

Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if a risk of collision exists. If there is any doubt such risk shall be deemed to exist

- If the bearing to an approaching vessel does not noticeably change a risk of collision exists.

- Even if the bearing changes, a risk of collision may still exist — particularly when the approaching vessel is large or at close range.
- If you are unsure you must assume there is a risk of collision and act accordingly.



A constant bearing indicates a risk of collision.

Rule 8 — Action to avoid collision

Any action taken to avoid collision shall, if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship.

- Before the vessel is in a close quarters situation, positive action to avoid a collision should have taken place.
- The action needs to be easily apparent to the other vessel. For example, a large course alteration of 60 degrees is preferred rather than a series of 20 degree course alterations.
- The effectiveness of the action should be monitored until the other vessel is well clear.

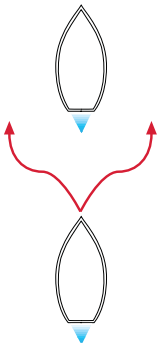
Rule 9 — Narrow channels

A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the outer limit of the channel or fairway which lies on its starboard side as is safe and practicable.

- Stay on the side of the channel that lies on the starboard side of your ship.
- If approaching a blind corner, navigate with particular caution and sound one prolonged blast (4-6 seconds) of the sound signal.

Keeping to starboard.

Rule 13 — Overtaking



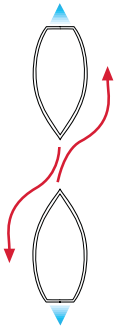
Overtaking vessel keeps clear.

Any vessel overtaking any other shall keep out of the way of the vessel being overtaken.

When a vessel is in any doubt as to whether she is overtaking another, she shall assume that this is the case and act accordingly.

- An overtaking situation remains an overtaking situation despite any subsequent alteration of the bearing between the two vessels.
- The duty of the overtaking vessel to keep clear remains until it is finally past and clear.

Rule 14 — Head-on situation



Head on situation – both alter course to starboard and give way to the other vessel.

When two power-driven vessels are meeting on reciprocal or nearly reciprocal courses so as to involve risk of collision, each shall alter its course to starboard so that each shall pass on the port side of the other.

When a vessel is in any doubt as to whether such a situation exists, she shall assume that it does and act accordingly.

- Each vessel in this case is a give way vessel and should, therefore, take early action to alter its course to starboard.

Rule 15 — Crossing situation

When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on its own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.

- The give way vessel should pass astern by altering course to starboard and if necessary, reduce speed to enable passing at a safe distance.

Rule 17 — Action by stand-on vessel

a) i) Where one of two vessels is to keep out of the way, the other shall keep its course and speed.

ii) The latter vessel may however take action to avoid collision by its manoeuvre alone, as soon as it becomes apparent to it that the vessel required to keep out of the way is not taking appropriate action in compliance with these Rules.

b) When, from any course, the vessel required to keep its course and speed finds itself so close that collision cannot be avoided by the action of the give way vessel alone, it shall take such action as will best aid to avoid collision.

In 2003, two passenger vessels collided in the Whitsunday Passage in open water, perfect weather conditions and with no other traffic in the vicinity. While one vessel had the right of way and the other should have taken action to avoid collision, both vessels stood on and each expected the other to alter course. Clearly, if the vessel in the stand on position thought that there was a risk of collision, action should have been taken according to the Rule 17.

- The stand-on vessel must take action if necessary to avoid collision.
- In doing so, a turn to port should be avoided in a crossing situation in case the give way vessel complies with its obligations at the last minute and turns to starboard which will result in a head-on collision.

Rule 18 — Responsibilities between vessels

a) Except where Rules 9 and 13 otherwise require; a power-driven vessel underway shall keep out of the way of:

i) a vessel not under command

ii) a vessel restricted in its ability to manoeuvre

iii) a vessel engaged in fishing

iv) a sailing vessel

c) a vessel engaged in fishing when under way shall, so far as possible, keep out of the way of:

i) a vessel not under command

ii) a vessel restricted in its ability to manoeuvre.

- There are exceptions to this rule. The most important exception is the overtaking situation, where even a sailing vessel, if overtaking a power vessel, is required to keep clear.

Rule 19 — Conduct of vessels in restricted visibility

Every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of restricted visibility. A power-driven vessel shall have its engines ready for immediate manoeuvre.

- Restricted visibility does not include the hours of darkness unless visibility is restricted by fog, mist, falling snow, heavy rainstorms, sandstorms or other similar causes.
- Under this rule, there are no give way or stand on vessels. Every vessel navigates with extreme caution, and if a vessel is detected forward of the beam that may be in close proximity, speed should be reduced to the minimum with which you can manoeuvre or, if necessary, take all way off until the danger of collision is over.

Remember: look all around, give way to starboard, turn to starboard and stay to starboard.

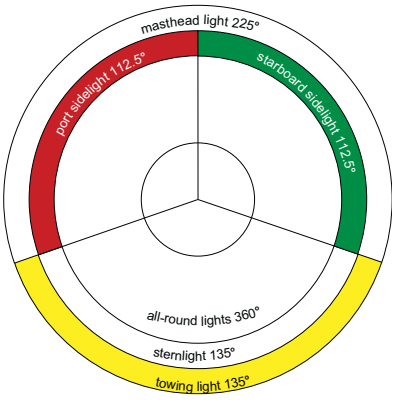
Navigation lights

By law boats operating from sunset to sunrise, whether at anchor or underway, must display the correct navigation lights.

A vessel is underway when it is not at anchor and is made fast to the shore or aground — a vessel vessel underway may in fact be stationary. A vessel being propelled through the water is said to be making way. In the Colregs, making way only has relevance to fishing vessels, vessels restricted in their ability to manoeuvre and vessels not under command.

Navigation lights can tell you approximately how large a vessel is, what operations it is currently engaged in (such as fishing or towing) and the approximate direction of its travel.

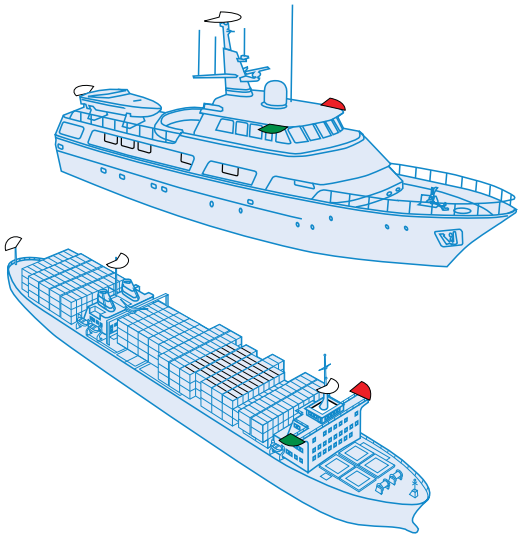
These lights must also be used in daylight hours during periods of restricted visibility or at any other time that it is deemed necessary. They must be positioned so that they are not obscured by the vessel's superstructure or interfered with by the deck lights.



Navigation lights and their arcs of visibility.

Power-driven vessels that are under 15 metres in length must display a foreward masthead light and a stern light.

Power-driven vessels that are 50 metres or more in length must display a second masthead light that is abaft and higher than the forward one.



Masthead lights.

Other lights and shapes

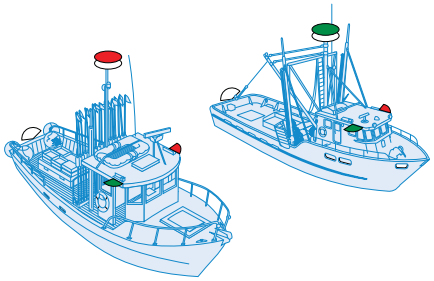
There are many other combinations of lights and shapes (for daytime use) that indicate the activity that the vessel is engaged in, such as fishing, dredging, constrained by its draught, or currently at anchor.

The following table summarises the most common types.

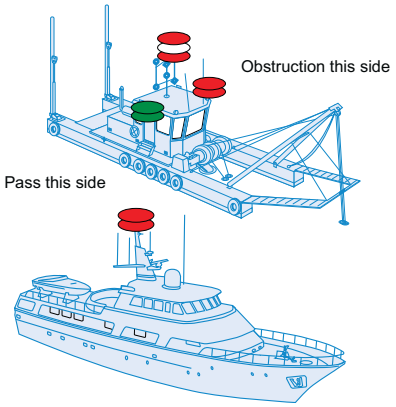
Keep out of the way

Vessel	Day shapes	'Signature lights'	Notes
Not under command *			Replaces masthead light(s)
Restricted in ability to manoeuvre *			
Constrained by draft			
Engaged in fishing *			
Engaged in trawling *			
Sailing		No masthead light	
Power-driven		Masthead light	
* displays sidelights and stern light only when making way			
Towing			Up to 200 m
			Over 200 m
* replaces one masthead light (same arcs as masthead) ** stern			
At anchor			
Aground			

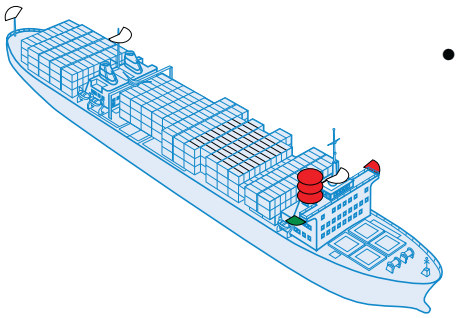
Smaller, power-driven vessels that do not display any lights other than navigation lights must keep clear of vessels as described below.



- Engaged in fishing and trawling.



- Vessel restricted in its ability to manoeuvre due to the nature of its work (top image) or a vessel not under command due to some exceptional circumstance (bottom image).



- A vessel that is constrained by its draught and, as a result, limited to a narrow channel or fairway.

Sound signals

The Colregs also include manoeuvring and warning signals that must be given when vessels are in sight of each other.

The most common signals are:

- 1 short blast – I am altering my course to starboard.
- 2 short blasts – I am altering my course to port.
- 3 short blasts – I am operating astern propulsion.
- 5 (or more) short blasts – I am in doubt of your intensions. (Note: A short blast is of about one second's duration)

The IALA buoyage system

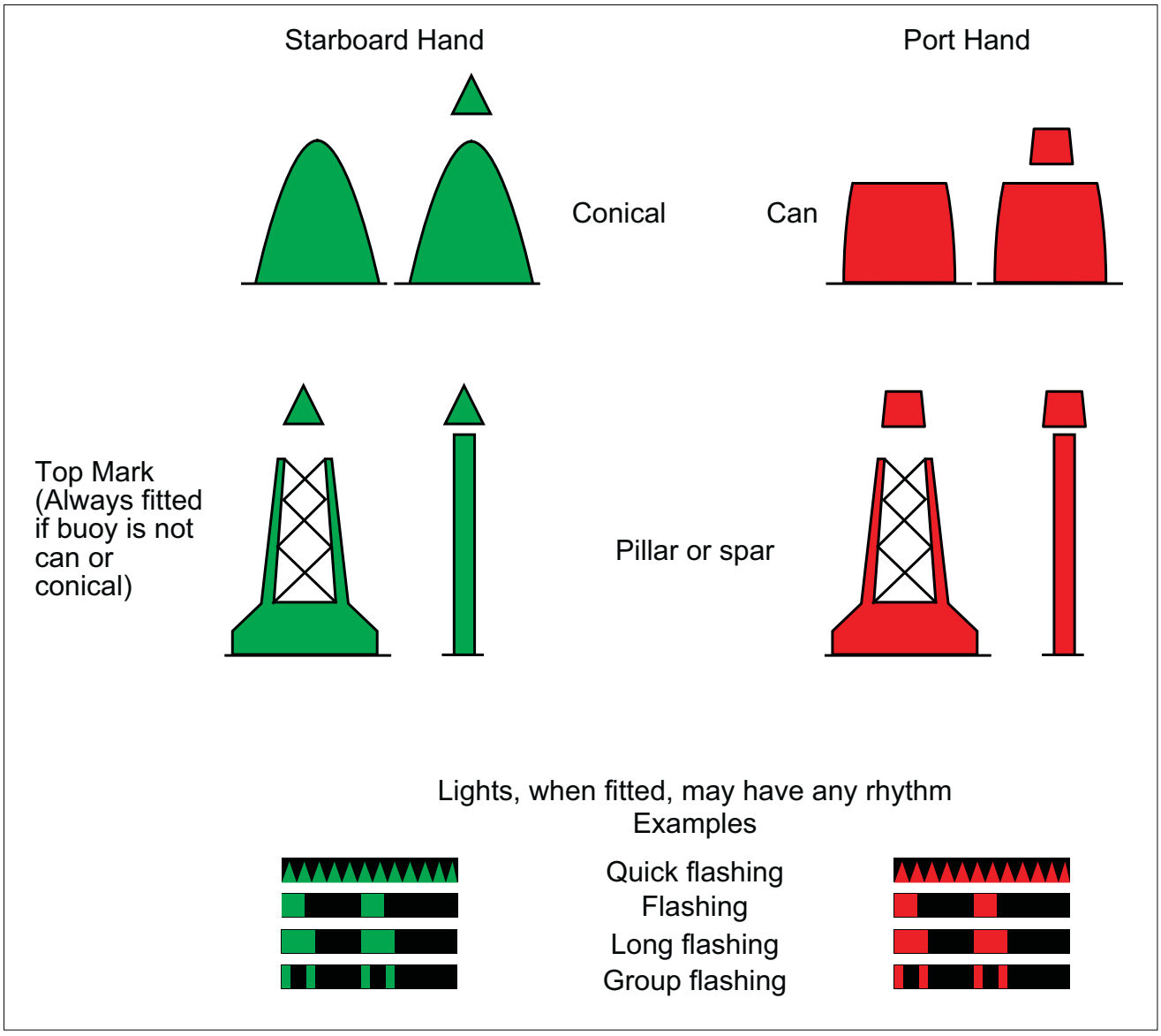
Queensland uses an internationally-recognised uniform coding system of navigation marks known as the International Association of Lighthouse Authorities (IALA) buoyage system 'A'. The system uses five different types of marks to distinguish safe navigation. It is essential for watchkeepers to recognise and pass them safely and in the correct manner.

Lateral marks

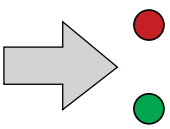
Lateral marks are positioned to define well-established channels and to indicate port and starboard sides of the navigation route into a port. Lateral marks are not always placed next to each other and the safe side to pass is determined by the direction of travel.

When coming from seaward (proceeding upstream, in the direction of flood tide or towards port), keep the red (port) lateral marks on your port side and the green (starboard) lateral marks on your starboard side.

The reverse applies when proceeding seawards.



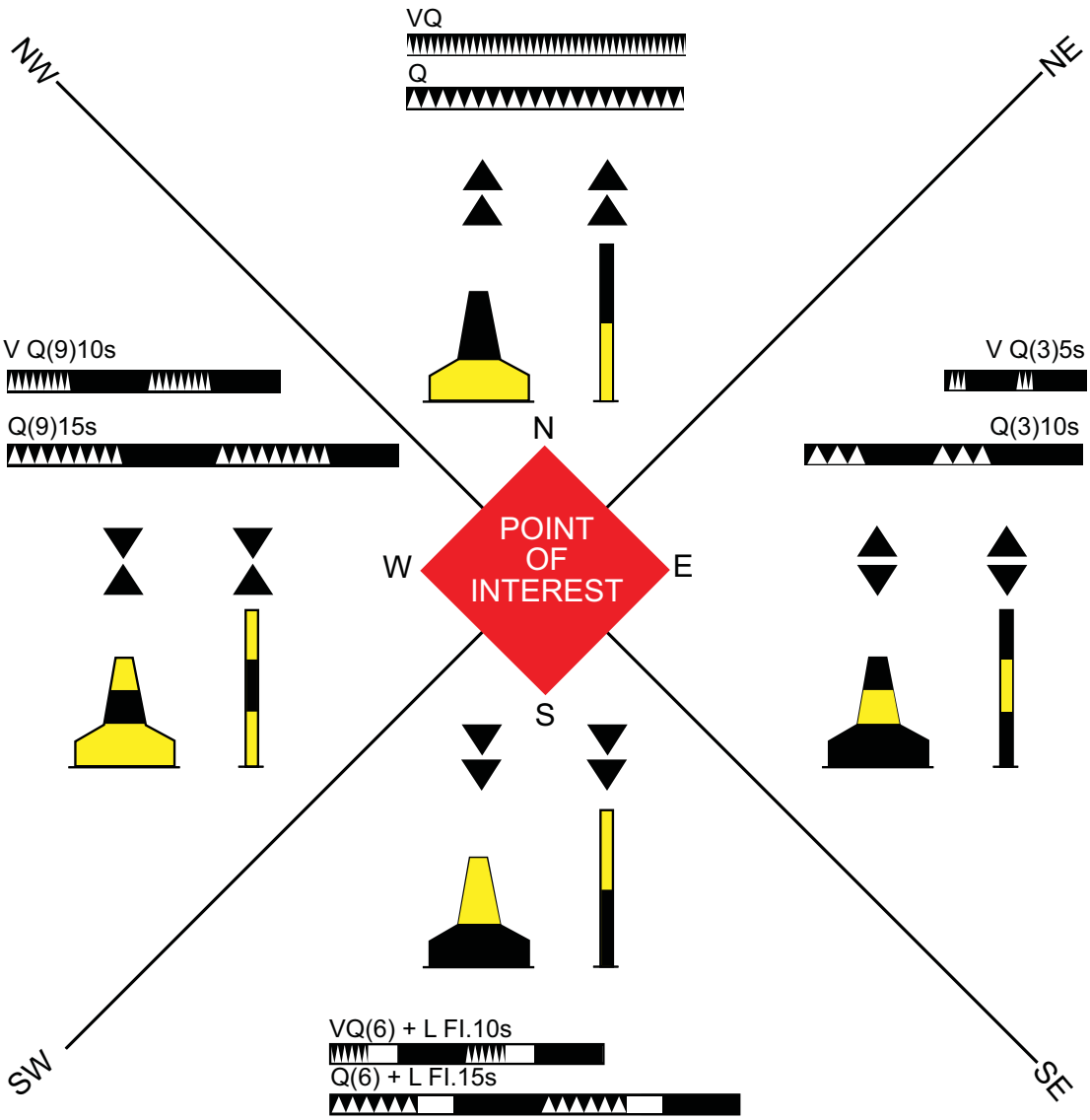
Where there is any doubt, the direction of buoyage is indicated on the chart by the symbol:



Lateral marks.

Cardinal marks

A cardinal mark indicates where the best and safest water may be found and is used in conjunction with a compass. Cardinal marks may indicate the deepest water in the area, the safe side on which to pass a danger or may draw attention to a feature in a channel such as a bend, junction or end of a shoal.



Note:
Certain types of buoy lighting equipment in current use on south and west cardinal light buoys have proved to be liable to occasionally exhibit one too many or one too few short flashes.

Cardinal marks.

Vessels should pass eastwards of an east cardinal mark, southwards of a south cardinal mark, westwards of a west cardinal mark, and northwards of a north cardinal mark.

By day, the colour scheme can be remembered by noting that the black on the pillar or spar is positioned where the conical topmarks point.

- North — the topmarks point up.
- East — the topmarks point outwards.
- South — the topmarks point downwards.
- West — the topmarks point inwards.

Cardinal marks (when they are lit) always display a quick flashing or a very quick flashing white light.

- North — flashes continuously.
- East — flashes in groups of three.
- South — flashes in groups of six (each group being followed by a long flash to aid in certain identification of a south cardinal mark as separate from the others).
- West — flashes in groups of nine.

To assist in remembering cardinal marks, associate the number of flashes of each group with that of a clock face. That means that north is at 12 o'clock, east is at three o'clock, south is at six o'clock and west is at nine o'clock.

Isolated danger mark

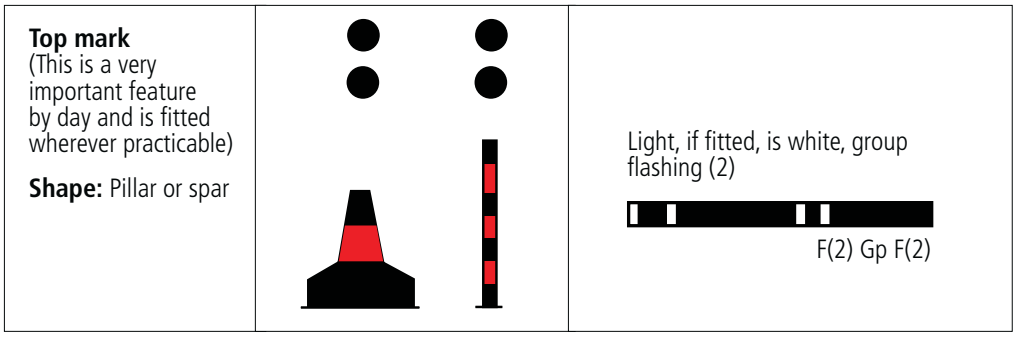
Isolated danger marks designate an isolated danger of limited extent which has navigable water all round it, for example an isolated shoal, rock or wreck.

Isolated danger mark features:

- Colour — black with one or more red horizontal bands.
- Top mark— two black spheres positioned vertically and clearly separated.
- Light — a white flashing light showing groups of two flashes.

The characteristics may be best remembered by association of two flashes with two spheres as the top marks.

Note: the danger may extend well beyond the mark so don't approach the isolated danger mark too closely.



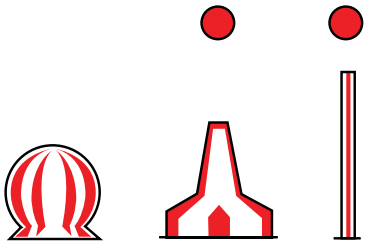
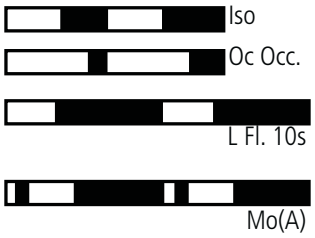
Isolated danger mark.

Safe water mark

Safe water marks indicate that there is navigable water all around the mark. Most commonly it indicates the seaward limits of harbour fairways.

Safe water mark features:

- Colour— red and white vertical stripes.
- Top mark — a single red sphere.
- Light — exhibits a white light, isophase, occulting, or single long flash every 10 seconds.

Top mark (If the buoy is not spherical, this is a very important feature by day and is fitted wherever practicable) **Shape:** Spherical or pillar or spar		Light, when fitted, is white, Isophase, or Occulting, or long flashing every 10 seconds, or Morse A 

Safe water mark

When lit, this mark will usually display a single white flash (either long, occulting or isophase) every 10 seconds. Occasionally, Morse 'A' (one short, one long flash) may be displayed.

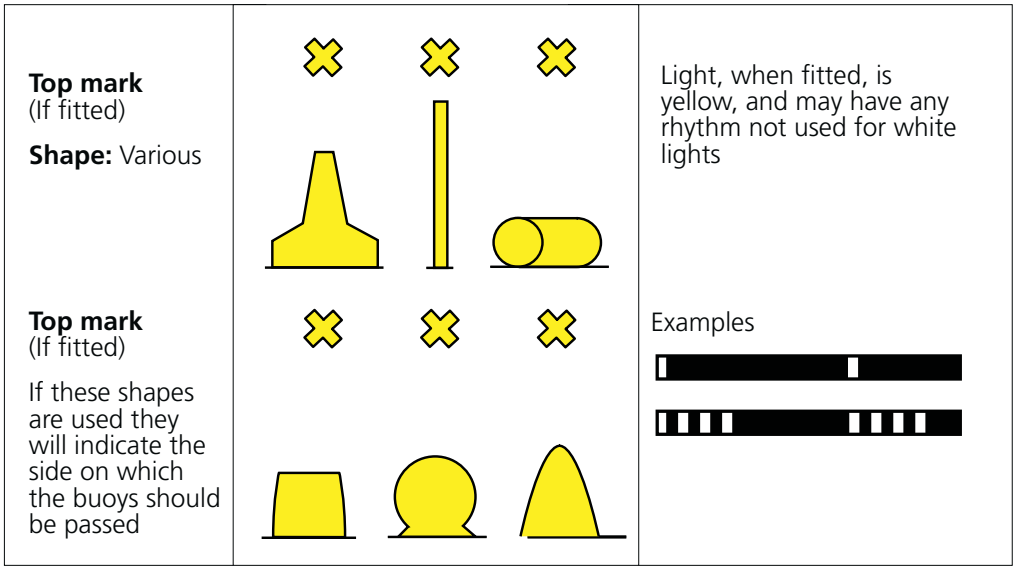
Special Mark

This mark usually indicates a special area or feature such as spoil ground, traffic separation, cables or pipeline. They can also define a channel within a channel.

A chart of the area should be consulted to be certain of the purpose of a particular special mark and on which side to pass.

Special mark features:

- **Colour** — yellow.
- **Top mark** — when a topmark is carried, it takes the form of a single yellow X.
- **Light** — it is yellow and the rhythm may be any other than those used for the white lights of cardinal, isolated danger and safe water marks.



Special mark.

Other beacons and lights

Leading beacons

Leading beacons are used to guide boats into a port of through sections of a waterway. It is essential to consult a chart for relevant leads and other navigatonal aids before entering unfamiliar waters.

Most commonly, they have topmarks that are triangular in shape; the front beacon having its apex upwards and the rear beacon (which is elevated higher) has its apex downwards. When the beacons are in transit they appear to point to each other.

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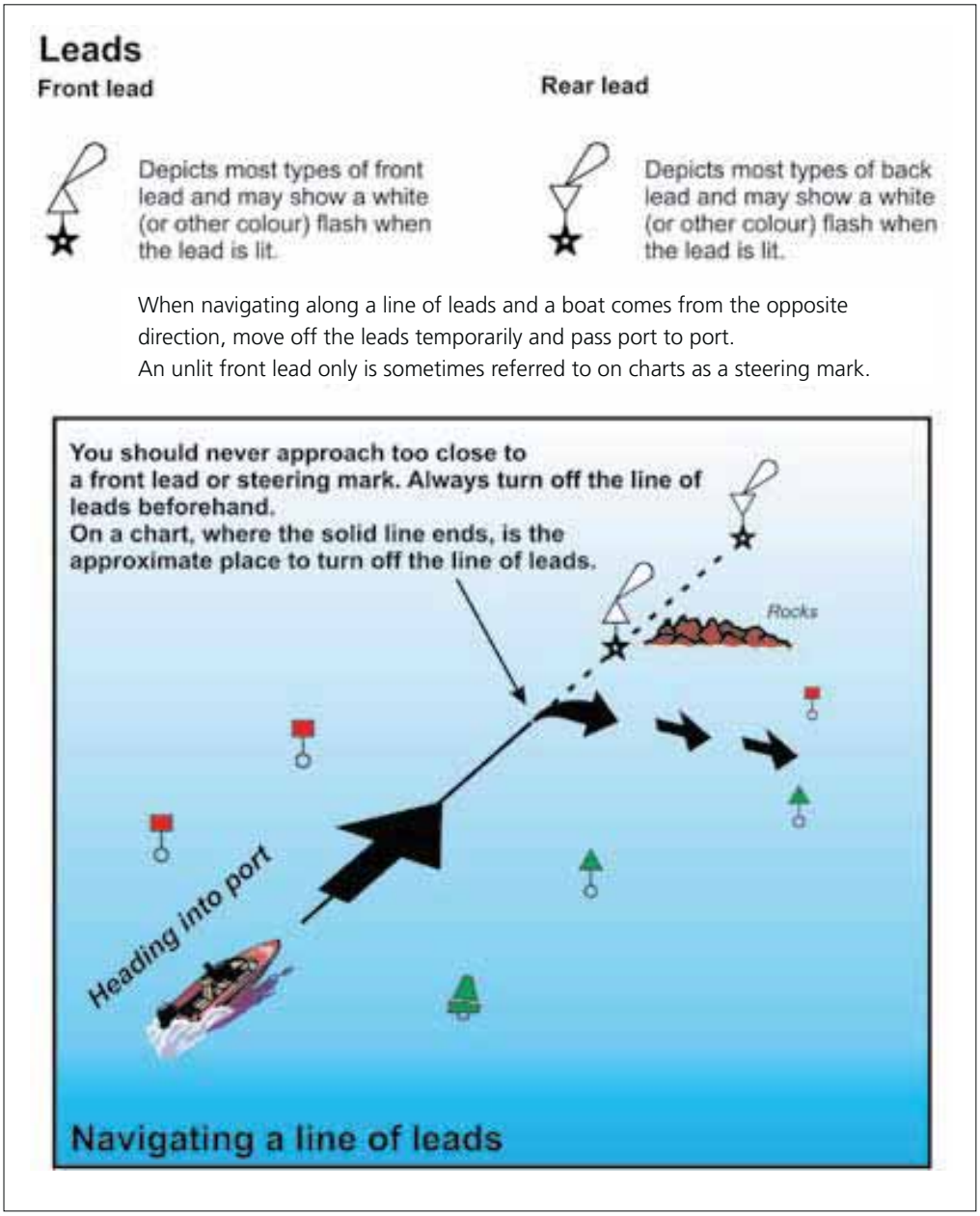
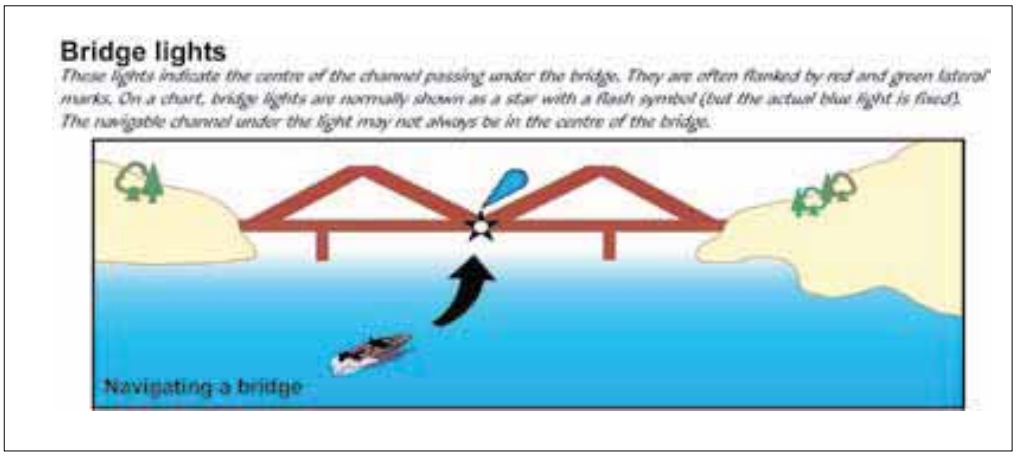


Leading beacons.

Given that leading beacons usually indicate larger, more navigable channels, remember that if the leads are in line, then the vessel will be positioned right in the centre of that channel. Open the leads up slightly to starboard so that the ship is compliant with Rule from the Colregs that states a vessel should keep as far to the starboard side of a narrow channel as is safe or practicable. This is particularly important at night.

More recently, leading beacons do not have a topmark at all, but are lit with white day lights. At night the light is often (but not always) fixed blue. This is common when a lot of background light is present, such as in major ports. Fixed blue lights are also used to mark the centre of the channel on overhead bridges.



Bridge lights.

Directional and sector lights

These lights assist watchkeepers in ascertaining whether or not their vessel may be proceeding into danger. Directional lights may only show through a very small arc (less than six degrees) and serve the same purpose as leading beacons.

Leads and sector lights

Sector lights normally display arcs of different coloured lights to warn mariners of hazards and advise of clear channels. Often, major lighthouses (such as the Bustard Head lighthouse in Queensland, pictured above) will be a sector light. It flashes red through the arc in which dangerous offshore rocks are located.

Advisory signs

Advisory signs are installed to advise on matters of importance to navigational safety, including:

- prohibited anchoring
- speed limits
- submarine cable crossing (anchoring is prohibited within 200 metres of submarine cables. If an anchor becomes fouled near one of these signs, it should not be retrieved).

CHAPTER 7

Introduction to chartwork

The first step towards proficiency in navigation to watchkeeping standards is understanding how to interpret a nautical chart. This fundamental knowledge will be the foundation from which all the other skills of the navigator can be built upon. If the chart cannot be understood, then the ship's position cannot be determined and dangers will not be recognised by the watchkeeper.

Even with today's modern satellite technology, there is no substitute for the paper chart. Combined with a magnetic compass and traditional navigational tools, like dividers, parallel rulers, safe coastal navigation by a competent watchkeeper is always possible without the use of modern navigation equipment. Remember that ultimately the ship should be self sufficient in every way. The ability to determine the vessel's position by use of a chart is vital in the event that the vessel's GPS unit should fail.

Many thousands of hours and huge amount of survey work has gone into each chart. Avoid folding the chart if possible and keep them corrected and up to date at all times —this is a statute requirement with regard to the seaworthiness of the ship. Aside from a ready reference chart that may be exposed to the elements, don't use charts that are laminated for watchkeeping purposes — they are slippery under the parallel rulers and impossible to use a pencil on. Laminated charts should not be used for position determination.

Chart interpretation

Projections — how the Earth appears on the chart

There are numerous ways in which the Earth's spherical surface can be projected onto a flat chart and all have some elements of distortion. For navigation at sea, two projections are used: Mercator projection and Gnomonic projection.

Gnomonic projection

The Gnomonic projection is used for ocean navigation. It is commonly used for planning purposes to establish 'great circle routes' which represent the shortest distances between positions, but would show up on the Mercator projection as a curved lines bulging towards the poles.

Mercator projection

The Mercator projection is used for coastal and inshore navigation, it is an important projection for watchkeepers to be aware of. This method of projection distorts features and landmasses.

- **Lines of longitude** (meridians) run through the north and south poles, and converge with each other as distance increases from the equator — think of the earth being cut into lemon wedges.
- **Lines of latitude** (parallels) travel around the Earth east to west but never meet — think of the earth being cut into a rectangle rather than a sphere.

Both latitude and longitude represent angular distances, with the apex of that angle measured from the geometric centre of the earth, in two dimensions — north/south (latitude) and east/west (longitude). These angular distances are represented on the chart. The scale of latitude runs down either side and the scale of longitude runs across the top and the bottom. With a Mercator chart, meridians of longitude do not converge at the poles.

The charts used for coastal navigation are a much larger scale, however, the same principle applies as they are still in Mercators projection.

Measuring distance

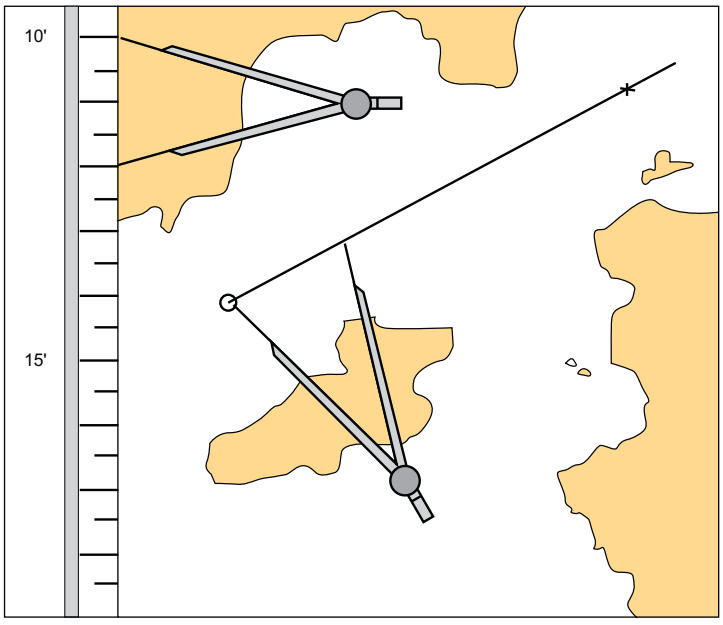
The unit of measurement at sea is the nautical mile and measuring distances on the chart using this unit is simple:

- One degree of arc is further divided into 60 minutes.
- One minute of arc at the Earth's surface is equal to one nautical mile.

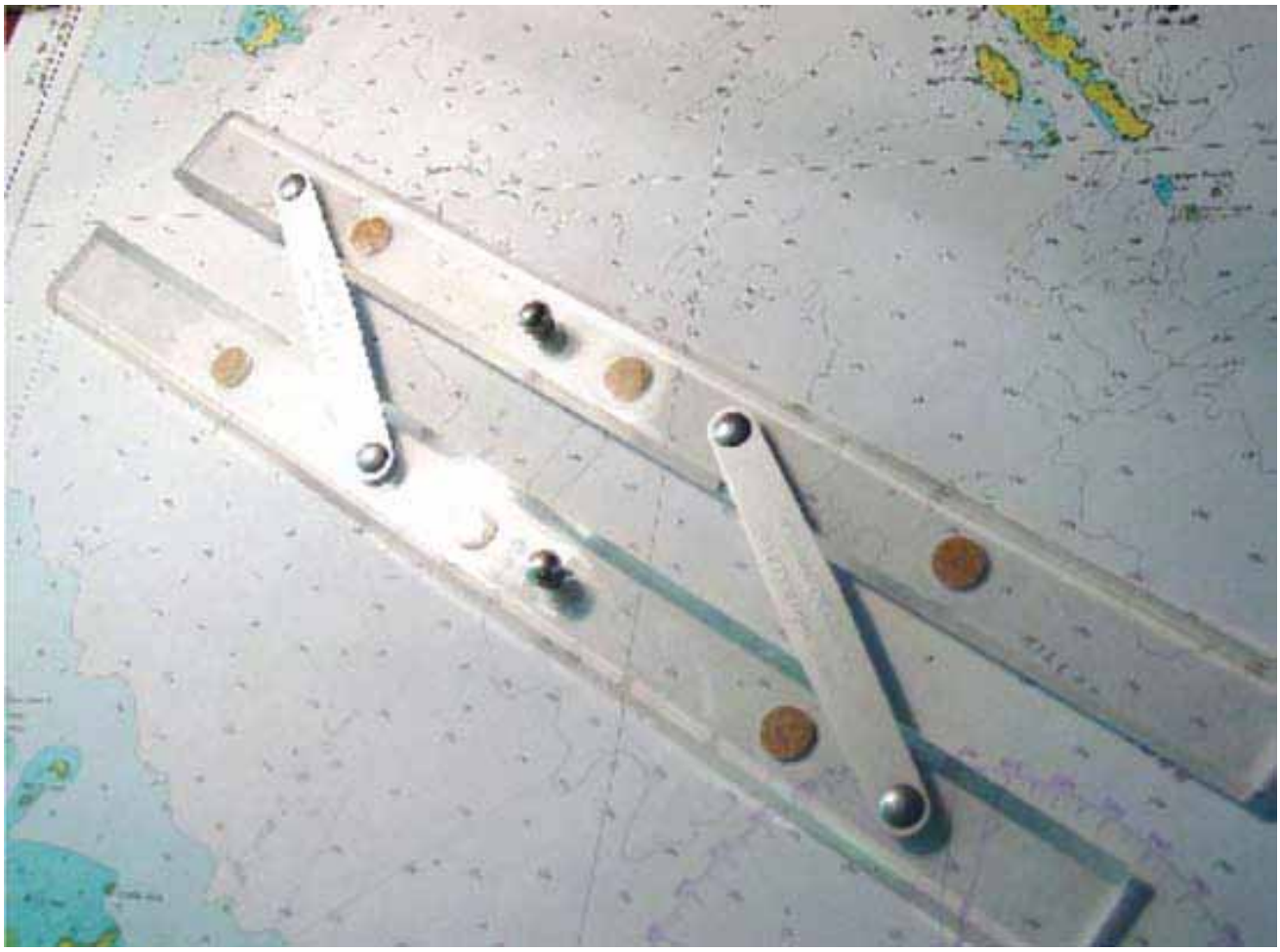
Therefore one degree of arc (measured from the centre of the Earth) is equal to 60 nautical miles.

Dividers

To measure distances on a chart in any direction, use dividers and transfer the distance, or step out the distance, from the latitude scales. This must be done in the vicinity of the passage latitude, since the latitude scales vary slightly down the chart (on a small-scale chart, this variation may be substantial). Read off the minutes in tenths and call them nautical miles. Accuracy should be to the nearest tenth (cable).



Measuring distance



Parallel rules

Primarily used for transferring bearings to or from the 'compass rose' on the chart, parallel rules are also used to read of the scales of latitude and longitude. Some practice is required to become proficient in the use of them, as they are prone to slip on the chart despite the non-slip cork material that is applied to the underside of some types. Even a small slip can result in a very large navigational error.

Practice 'walking' the parallel rules from one side of the chart to the other – see if they meet the opposite side of the chart aligned perfectly with the scale.

Interpreting chart symbols

The symbols shown on official charts, such as those produced by the Australian Hydrographic Service and Maritime Safety Queensland conform to guidelines contained in the publication *Symbols and Abbreviations used on Admiralty Charts* (Chart 5011).

This is produced by the United Kingdom Hydrographic Office and provides and interpretation of the symbols used on navigation charts.

Extracts from AUS5011:

Lights

Light Characters			Light Characters on Light Buoys →IQ	471.2 K21-30a
	Abbreviation		Class of Light	Illustration — Period shown →
	International	National		
10.1	F		Fixed	
10.2	Occulting (total duration of light longer than total duration of darkness)			
	Oc	† Occ	Single-occulting	
	Oc(2) Example	† GpOcc(2) Example	Group-occulting	
	Oc(2+3) Example	† GpOcc(2+3) Example	Composite group-occulting	
10.3	Isophase (duration of light and darkness equal)			
	Iso		Isophase	
10.4	Flashing (total duration of light shorter than total duration of darkness)			
	Fl		Single-flashing	
	Fl(3) Example	† GpFl(3) Example	Group-flashing	
	Fl(2+1) Example	† GpFl(2+1) Example	Composite group-flashing	
10.5	LFl		Long-flashing (flash 2s or longer)	
10.6	Quick (repetition rate of 50 to 79 - usually either 50 or 60 - flashes per minute)			
	Q	† QkFl	Continuous quick	
	Q(3) Example	† QkFl(3) Example	Group quick	
	IQ	† IntQkFl	Interrupted quick	
10.7	Very quick (repetition rate of 80 to 159 - usually either 100 or 120 - flashes per minute)			
	VQ	† VQkFl	Continuous very quick	
	VQ(3) Example	† VQkFl(3) Example	Group very quick	
	IVQ	† IntVQkFl	Interrupted very quick	
10.8	Ultra quick (repetition rate of 160 or more - usually 240 to 300 - flashes per minute)			
	UQ		Continuous ultra quick	
	IUQ		Interrupted ultra quick	
10.9	Mo(K) Example		Morse Code	
10.10	FFl		Fixed and flashing	
10.11	Al.WR Example	Al.WR Example	Alternating	R W R W R W

Buoys and beacons

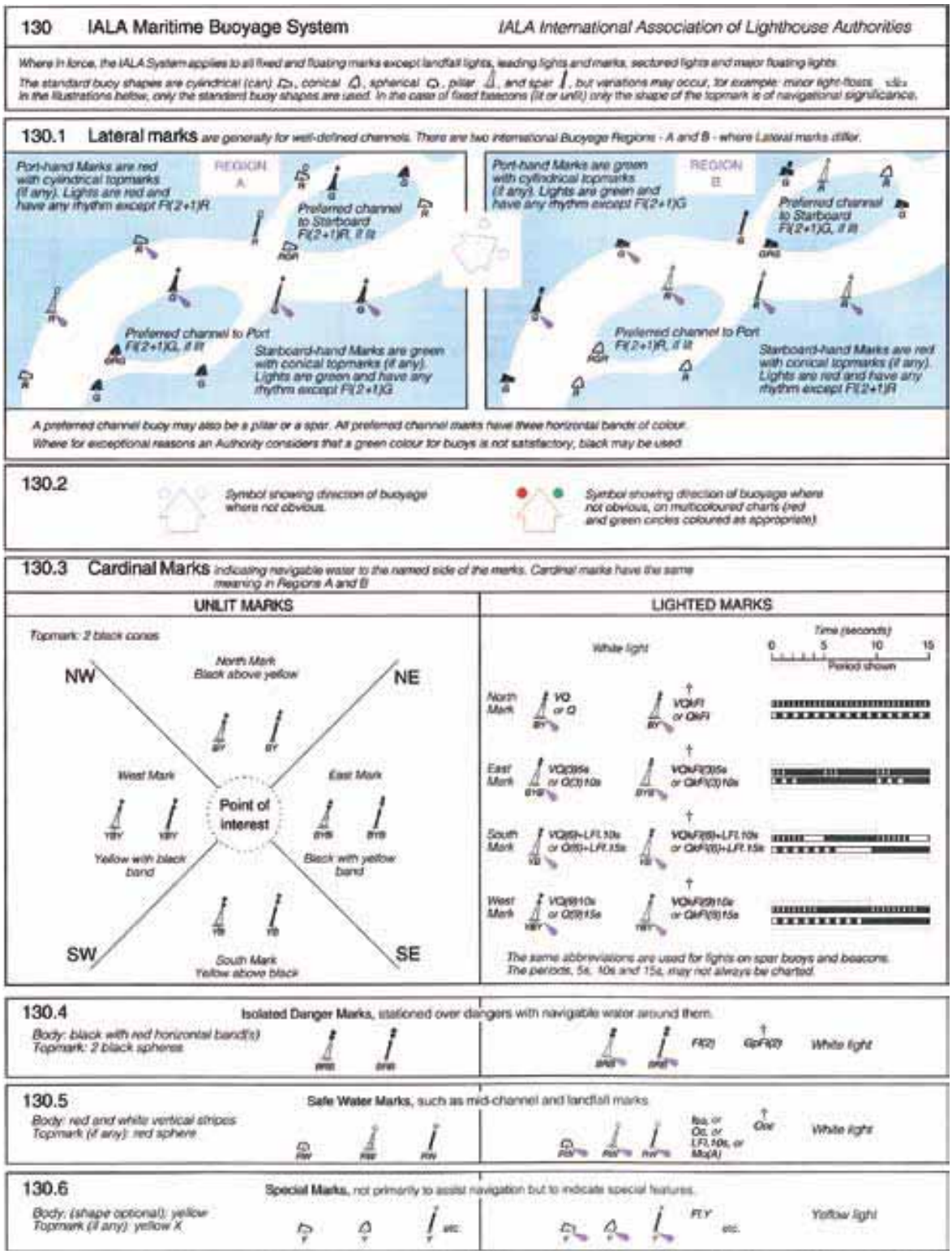


Chart datums

All depths on the chart (called soundings) are measured from the chart datum for depths. Usually, this will be the lowest astronomical tide (LAT) — that is, the lowest tide that could be theoretically predicted to occur under average meteorological conditions.

All heights on the chart are measured from the chart datum for heights. Usually, this will be mean high water springs (MHWS) which is the long-term average of the heights of high water at full and new moon.

All clearances on the chart (such as those under bridges or power cables) are usually measured from highest astronomical tide (HAT), the highest tide that could be theoretically predicted to occur under average meteorological conditions. Additionally, a safety margin is also added to clearances.

The compass rose

Every chart will normally have at least two compass roses that are printed in the colour magenta (because magenta shows up boldly under red light, which is used at night to protect the watchkeeper's night vision). These are used in conjunction with parallel rulers to transfer bearing lines and course lines across to the rose so that they can be given a true angular notation.

For example, if a line is drawn across a body of water on the chart along which the vessel is to travel, this line must be transferred by 'walking' the rule from it across to the nearest compass rose to read off a true bearing. The process is reversed in the case of a compass bearing taken of a landmark.

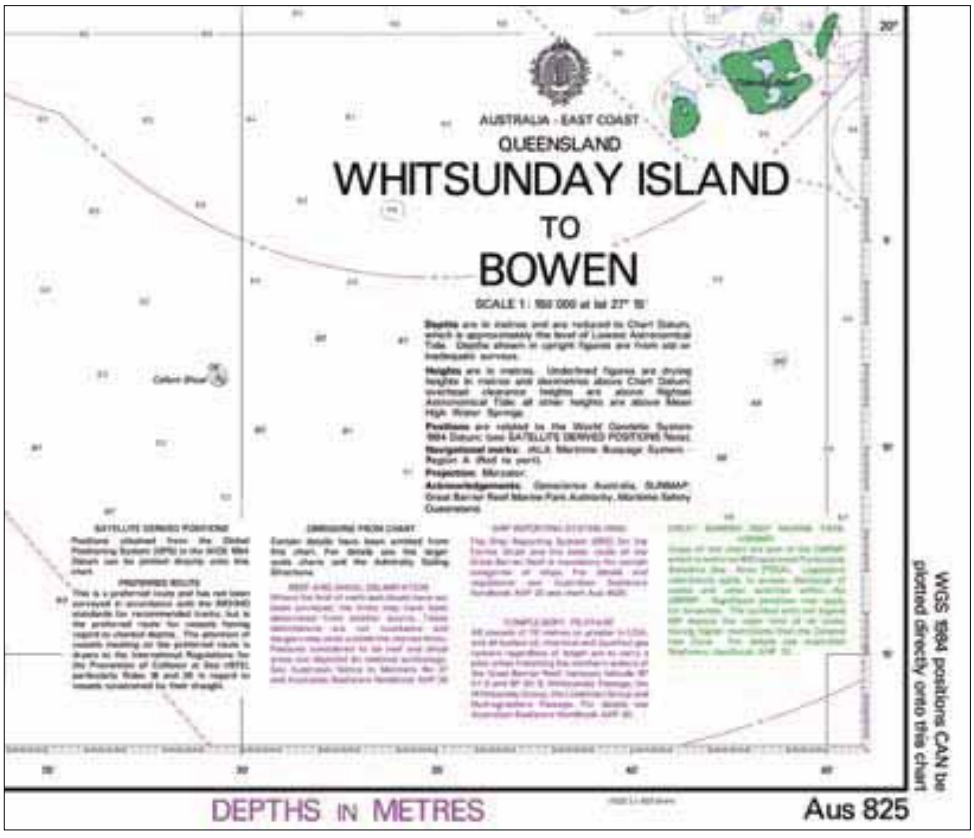


Chart title block

Chart datum can be found in the chart's title block, along with other important information including magnetic anomalies, recommended tracks and marine protected areas. The scale of the chart can also be found here.

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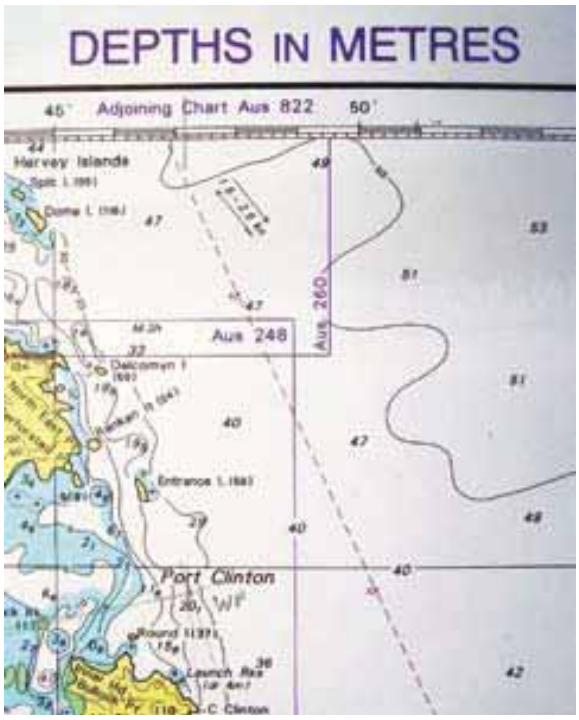
The compass rose also indicates the variation of the Earth's magnetic field in the area, including how much it is increasing or decreasing each year. This error must be applied, along with any deviation of the compass caused by the influence of the ship itself (particularly those constructed of steel) and is the subject of further study beyond the scope of this publication.

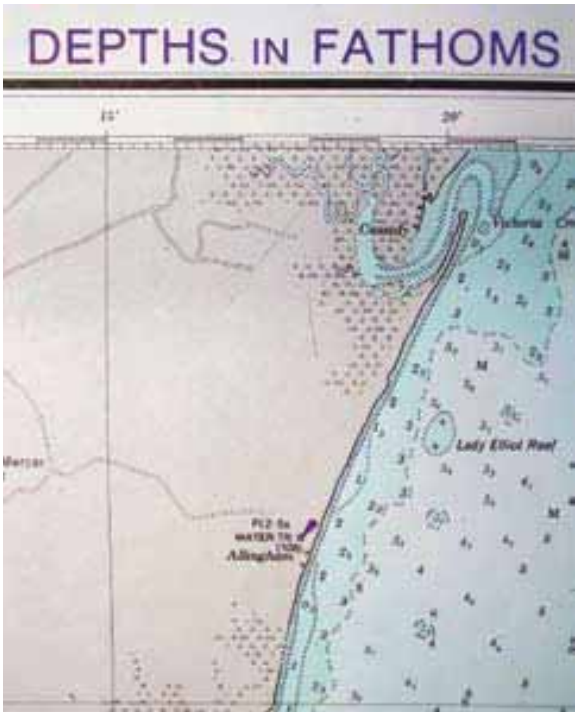
Metric and imperial charts

Although most charts of the Australian coastline are now metric, several older charts are still in use. Care needs to be taken when moving from one chart to another, particularly with regard to depths, as a different unit of measurement may have been used.

As shown below, metric and imperial charts are not only indicated as such on the upper left, and lower right corners of the chart, but also by their colour schemes — land is yellow on metric charts and grey on imperial charts.



Metric chart



Imperial chart.

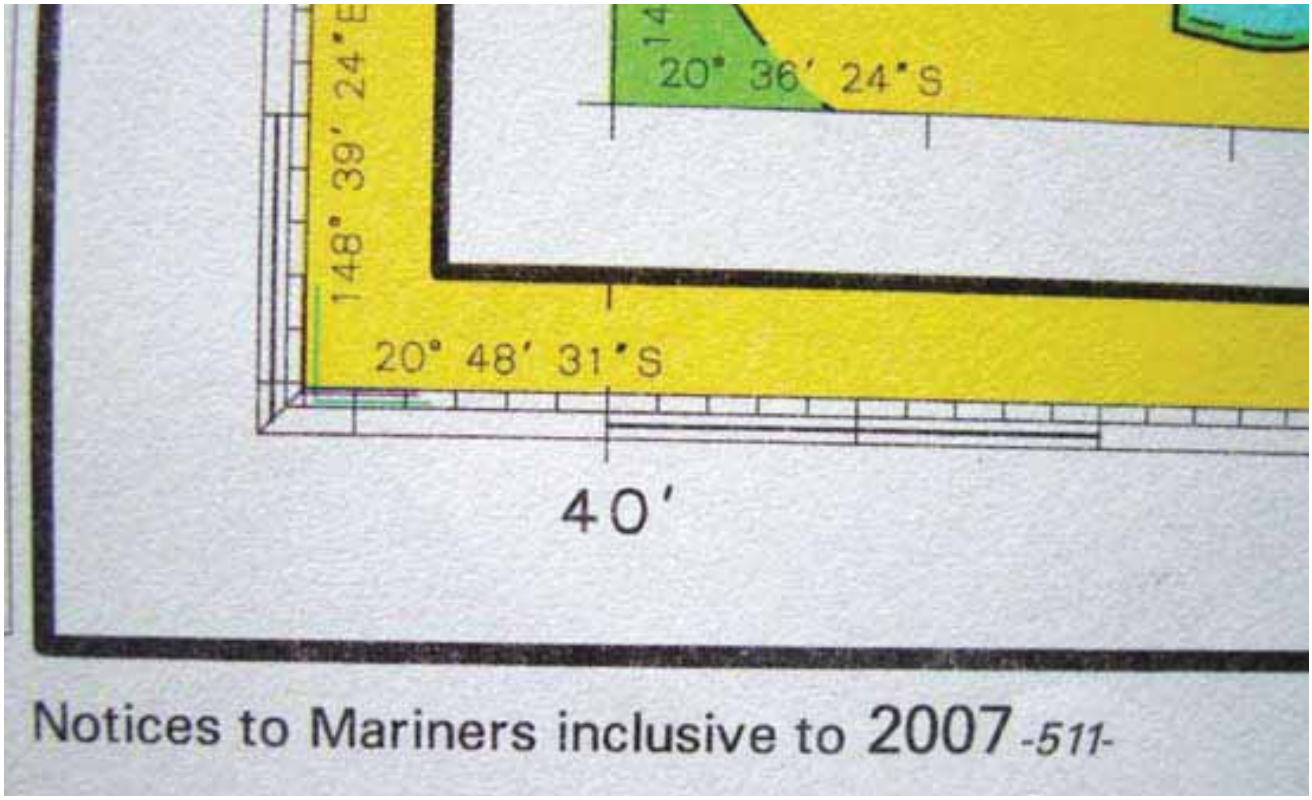
Notices to Mariners

Notices to Mariners are issued by the Australian Hydrographic Service and Maritime Safety Queensland and advise of:

- navigation warnings and hazards (such as aids to navigation that may have been destroyed, missing or unlit)
- changes to the uniform buoyage system (which assists with the correction and updating of marine charts)
- navigation depths (necessary when navigating in channels with depth restrictions)
- any other works that may affect the safe navigation of vessels in Queensland and Australian coastal waters and ports (such as dredging operations and construction works).

The Notices are used to make corrections and changes to charts with the correction year and Notice number listed at the bottom left-hand corner of the chart. Notices are either

temporary or permanent corrections to the chart. Permanent corrections are to be made with a magenta pen and temporary corrections made with a pencil.



This chart has been corrected at the date of purchase to the Notices to Mariners number shown. Further corrections are the duty of the master/navigator.

CHAPTER 8

Special requirements

Sailing vessels

The days of using sailing vessels for commercial trade at sea are long gone. In Queensland, however, there are many sailing vessels operating commercially in the tourism sector.

Working onboard a sailing vessel involves utilising a different set of seafaring skills and occupational health and safety issues compared to powered vessels. For example, crew members on a sailing vessel may be required to work at height on a tall mast.

Sailing ships generate enormous horsepower from the wind.

A crew member working on the deck of a sailing vessel should be securely clipped on with a safety harness at all times and be aware of the strain that each line is under.

Things to be aware of on sailing vessels

- **Lines under great tension**

  Don't release them suddenly and let them run through your hands as this will cause a rope burn injury. Keep a few turns on the belaying pin and cleat or winch until you are sure the tension is manageable.

- **Always know where the wind is coming from**

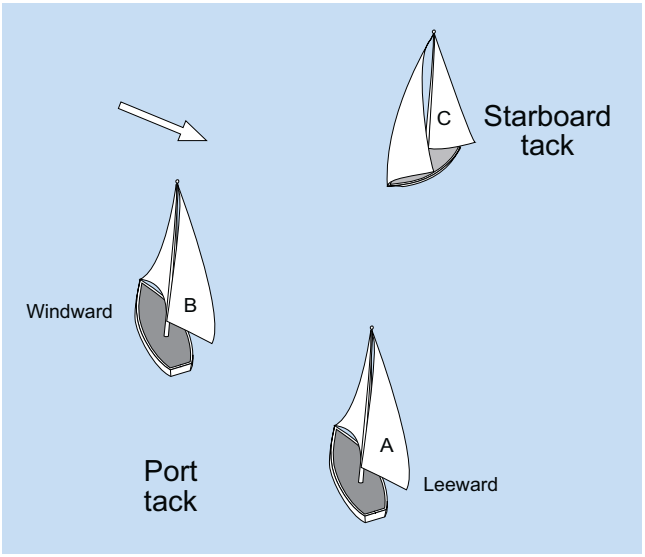
  Sloppy helmsmanship can put the wind on the wrong side of the sails and cause them to crash to the other side of the vessel which can result in damage to the vessel and injury to crew or passengers.

- **Know the collision regulations**

  In conjunction with the Rules outlined in chapter 6, the following Rules must be followed when operating a sailing vessel.

  Rule 12, Sailing vessels — starboard tack has right of way over port tack; leeward boat has right of way over windward boat.

  If overtaking, Rule 13 will apply — you must give way at all times, even if the vessel being overtaken is powered.



Sailing vessels

- **Practice man overboard drills**

  Keep in mind when going through the drill that a sailing vessel is not as easy to bring to a stop as a powered vessel.

- **Be particularly vigilant with regard to passenger safety**
- **The deck of a sailing ship is full of lines under tension and many high risk areas.**

Barges and cargo conveyance

Commercial barges operate on many smooth and partially smooth waterways in Queensland.

Barges are susceptible to specific risks due to their design and the nature of the work they are engaged in.

Barges have a flat bottom and usually a low freeboard (the distance from the waterline to the uppermost continuous deck). They often have a flat deck as well, sacrificing deck camber for cargo-carrying ability.

As they are designed to carry large loads with little displacement and a shallow draft, stability considerations are important and all crew members should be trained to identify a potentially dangerous situation with regard to the distribution of weight onboard. Ultimately this is the master's responsibility, however, crew members should also be aware of a barge's specific requirements and safety hazards.

Personal protective equipment and high visibility clothing must be worn by crew members and cargo must be sufficiently secured to make sure that the barge won't capsize. Deck-edge immersion may occur if the cargo shifts and reduces the vessel's stability.

Things to be aware of:

- Distribution and securing of cargo.
- All watertight deck hatches and doors must be closed before embarking to sea and must remain closed for the duration of the voyage.

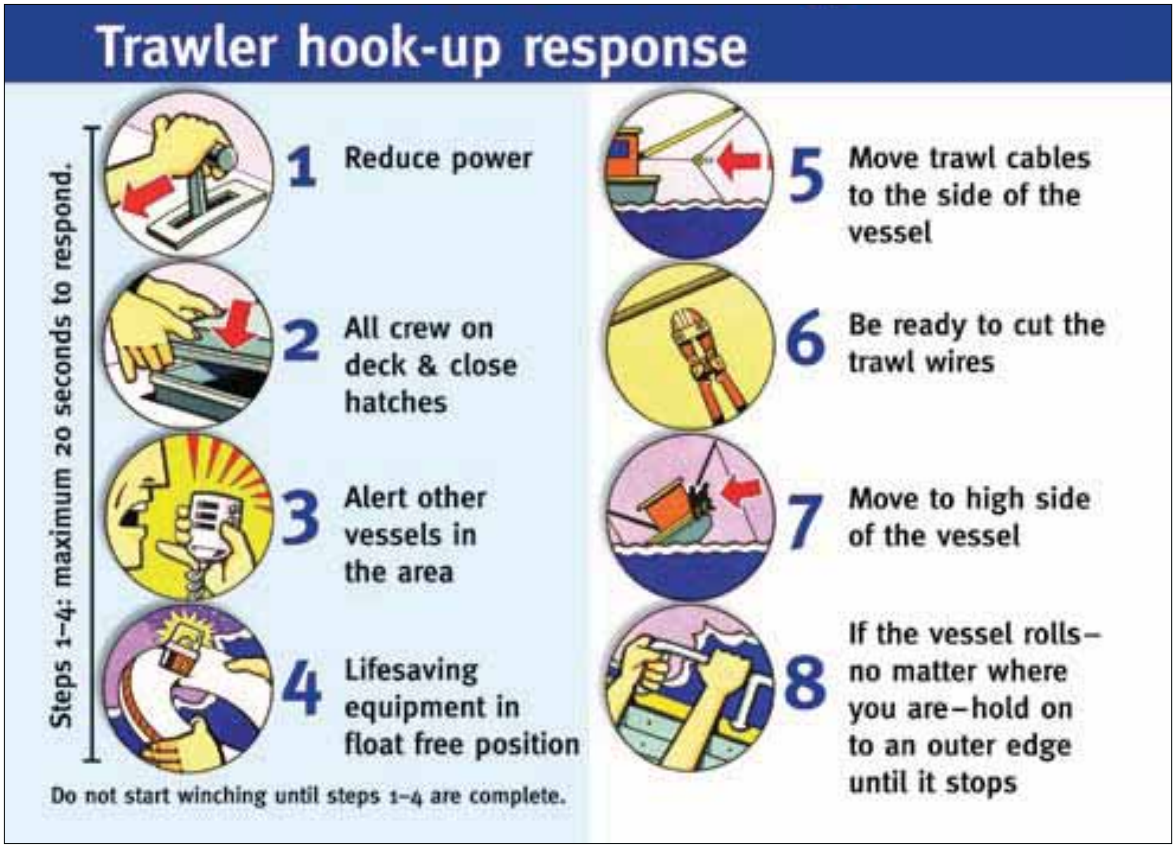
- Be aware of free surface effect — it affects barges considerably due to their box-like shape.
- Wear personal protective equipment and ensure communication between crew and master is efficient and clear.
- Watch the tidal rise and fall — barges often operate in very shallow water. If unloading on a falling tide, efficiency and teamwork is important.

Trawlers

One of the most common causes of trawlers being lost at sea is the result of the sudden loss of stability due to an unexpected shift in the centre of gravity resulting in capsize.

While this is sometimes due to the free surface effect of shifting weight on deck, often it is the result of a hook up — the sudden fouling of equipment around an obstruction on the sea bed. This situation is almost impossible to predict as many undersea hazards have not been charted.

All crew members should be aware of their responsibilities when responding to a hook up to ensure the procedure is executed as quickly as possible.



It is important on trawlers to have safety equipment, such as an EPIRB (pictured), installed in a float free position. This means that the equipment will float free in the event of a hook up rather than going down with the capsizing vessel.

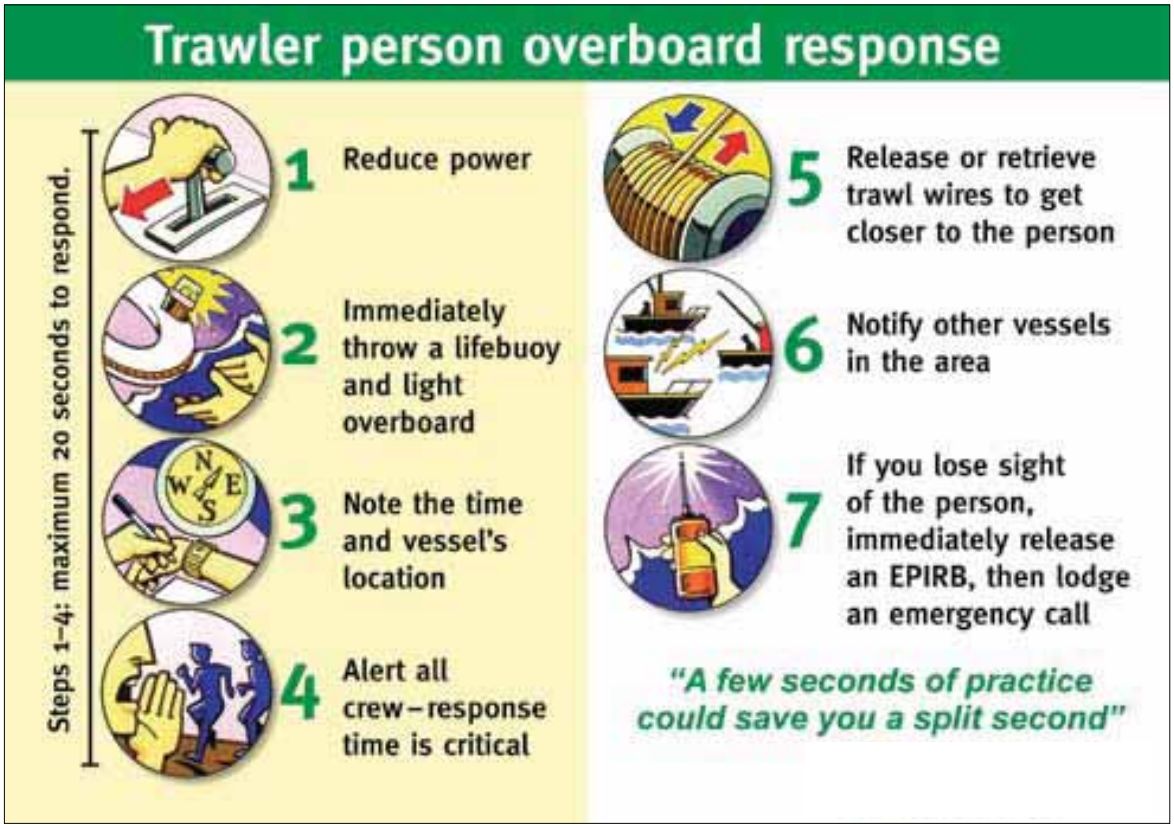
A sudden capsize is frightening and for those below deck the chances of survival are limited as water pours in, the lights go out and the ability to find the way out of the hull

Float free EPIRB.

is diminished by disorientation, panic and lack of air.

Trawler person overboard response

Working on the deck of a trawler, particularly if there is a large sea running, carries the risk of a person falling overboard. A fast response time from the crew members onboard will greatly increase the chances of the person overboard being retrieved in difficult sea conditions. Maritime Safety Queensland recommends the below seven-point response to a person overboard and this procedure should be drilled regularly so that crew members know their responsibilities.



Working alone

Even though a ship at sea with a full crew may seem confined at times, there are many cases where crew members may have to work alone, for example fishing from a dory away from the mother vessel.

Things to be aware of

- Protection from the sun — heatstroke can cloud judgement.
- Maintain communication with the vessel and report the tender's position regularly.
- Always wear a kill switch lanyard at any time the outboard motor is operating and in gear.
- Watch the weather and remember how suddenly it can change for the worse. If in doubt, get out.
- Don't take risks — even the most sure-footed can fall overboard. Stop the boat and at the very least engage neutral gear before moving around the dory.

Conclusion

A career in the maritime industry is a rewarding one

The opportunities for travel, financial reward and job satisfaction are enormous as a crew member on a commercial vessel. Additionally, the camaraderie that exists in a crew, combined with a healthy outdoor environment, present the new crew member with many opportunities for professional and personal reward.

However, such a rewarding work environment can only exist if it is a safe one where everybody knows their duties and carries them out responsibly.

As a newcomer to a vessel make sure that you take an active role in creating a safe and professional workplace by taking responsibility for your own education, looking after and maintaining the seaworthiness of the vessel and fostering a positive culture onboard.

Appendix

Glossary of terms

Abeam	At a right angle to the ship, but not on the ship.
Aft	Towards the rear of the ship.
AMSA	Australian Maritime Safety Authority
Astern	Behind the ship, but not on ship.
Beam	The greatest width of the ship.
Belay	To secure a line.
Bilge	The part of the floors of a vessel on either side of the keel which approaches closer to a horizontal rather than vertical direction. The very lowest part of a vessel's interior where water is likely to collect.
Bitts	Two solid posts, usually at or near the bows and stern of the ship, to which lines are secured. They differ from bollards in that they are not a fitting, but part of the structure of the ship.
Bollard	A solid post on the deck of a ship, or on a wharf or pier, designed for securing mooring lines. They are usually in pairs.
Bow	Generally, the most forward part of the ship, including the deck and hull.
Bridge/wheelhouse	The deckhouse of a vessel where the helm is located.
Bulkhead	A vertical partition separating compartments.
Bulwark	A railing around the deck of a vessel to keep things from going overboard and the seas from coming onboard; the strake of a shell plating above a weather or shelter deck; the part of a vessel's side that extends above the main deck to protect it against heavy weather.
Cast off	To untie the mooring lines and depart a wharf or pier.
Chine	The part of the hull where the sides and bottom meet in a flat or v-bottomed ship.
Cleat	A device for securing a small diameter line.
Coaming	A low barrier built around a hatch in the deck to prevent down flooding of water.
Davit	A spar used to hoist a small vessel, such as a life boat or tender, clear of the water for stowage.
Deadrise	The angle the bottom of a vessel forms with the horizontal plane.
Deck	Permanent covering of any ships compartment, or any part of a ship serving as a floor.
Deck head	In a house, this would be called the ceiling.
Derrick	A spar used for lifting weights or load bearing, such as handling or hoisting nets.
DGPS	Differential global positioning system
Draft	The distance between the waterline and the deepest part of the keel.

DSC	Digital selective calling
Eddy	Circular movement of water, usually due to tidal stream.
EPIRB	Emergency position indicating radio beacon
Fairlead	A device to guide lines, such as mooring lines, to minimise friction and reduce chafing.
Fore peak	The forward most compartment of the ship, often it is the chain locker in smaller vessels.
Freeboard	The distance between the lowest point of the main deck (usually near midships) and the waterline.
Freeing port	An opening in the bulwark or rail for allowing water to run off the deck.
GPS	Global positioning system
Gunwale (Pronounced 'gunnel')	Where the deck joins the hull, around the upper edge of a ships side.
HAT	Highest astronomical tide
Hatch	An opening in the deck fitted with a watertight cover.
Helm	The wheel or tiller controlling the rudder.
Hp	Horsepower
Hydrostatic release	A mechanism designed to release emergency equipment, such as a life raft, at a predetermined depth by way of water pressure.
Isobars	Lines drawn on a weather map indicating regions of equal pressure. When the lines are close together, this indicates a rapid change in air pressure, accompanied by strong winds.
Keel	The backbone of a boat, running fore and aft. The bottom of the keel is the deepest part of the vessel.
LAT	Lowest astronomical tide
Lifeboat	A small rigid vessel for use in emergencies on larger ships.
Liferaft	An inflatable raft for use in the event of abandoning ship.
Line	Rope and cordage used on ships.
List	The movement of a vessel away from upright because of uneven transverse distribution of weight.
Making way	A vessel making way is moving through the water. Not to be confused with under way.
Master	The captain of a vessel. The highest ranking officer aboard.
MHWS	Mean high water springs
Midships	The middle portion of the vessel, roughly halfway between a ship's stern and where the beam is usually the widest.
MLWS	Mean low water springs
Mooring	An arrangement for securing the vessel in open water or a pier.

MROCP	Marine Radio Operator's Certificate of Proficiency (for VHF and MF/HF radio operations)
MROVCP	Marine Radio Operator's VHF Certificate of Proficiency (for VHF radio operations)
MSQ	Maritime Safety Queensland
Muster	To assemble passengers and crew.
NMSC	National Marine Safety Committee
NSCV	National Standard for Commercial Vessels
Painter	A line secured to the bow of a small boat for use in towing, or tying up to a pier.
PFD	Personal flotation device — technical term for a life jacket.
Port	To the left hand side looking forward.
PPE	Personal protective equipment
PWC	Personal watercraft
Right of way	The right to maintain course and speed according to the rules of navigation. When two vessels are on intersecting courses, one vessel should stand on and the other should give way.
RMDL	Recreational marine driver licence
RTO	Registered training organisation
Scupper	Similar to freeing port. Drain holes in the bulwarks, toe rails or the deck itself.
Seaworthiness	The overall ability of a vessel to deal with its operating conditions, including aspects of construction, equipment, supplies and number of crew.
SMS	Safety management system
Starboard	To the right hand side of the vessel looking forward.
Stem	The very front edge of a ship's hull, where the port and starboard sides of the hull meet at the bow.
Stern	The back, or aft, part of a ship.
Tender	A small vessel used to transport crew and equipment from shore to a larger vessel.
TOMSA	Transport Operations (Marine Safety) Act 1994
TOMPA	Transport Operations (Marine Pollution) Act 1995
Transom	The athwartship portion of a hull at the stern. The flat, vertical aft end of a vessel.
Underway	A ship not attached to the shore or the ground in any manner. Usually, but not necessarily, moving through or making way through the water.
USL Code	Uniform Shipping Laws Code
Wash	Waves created by a vessel making way as it displaces water.

Smooth and partially smooth water limit maps

Because the conditions experienced on Queensland's waterways are so diverse, designated water limit areas have been established. These affect the types of regulated safety equipment required to be carried on board.

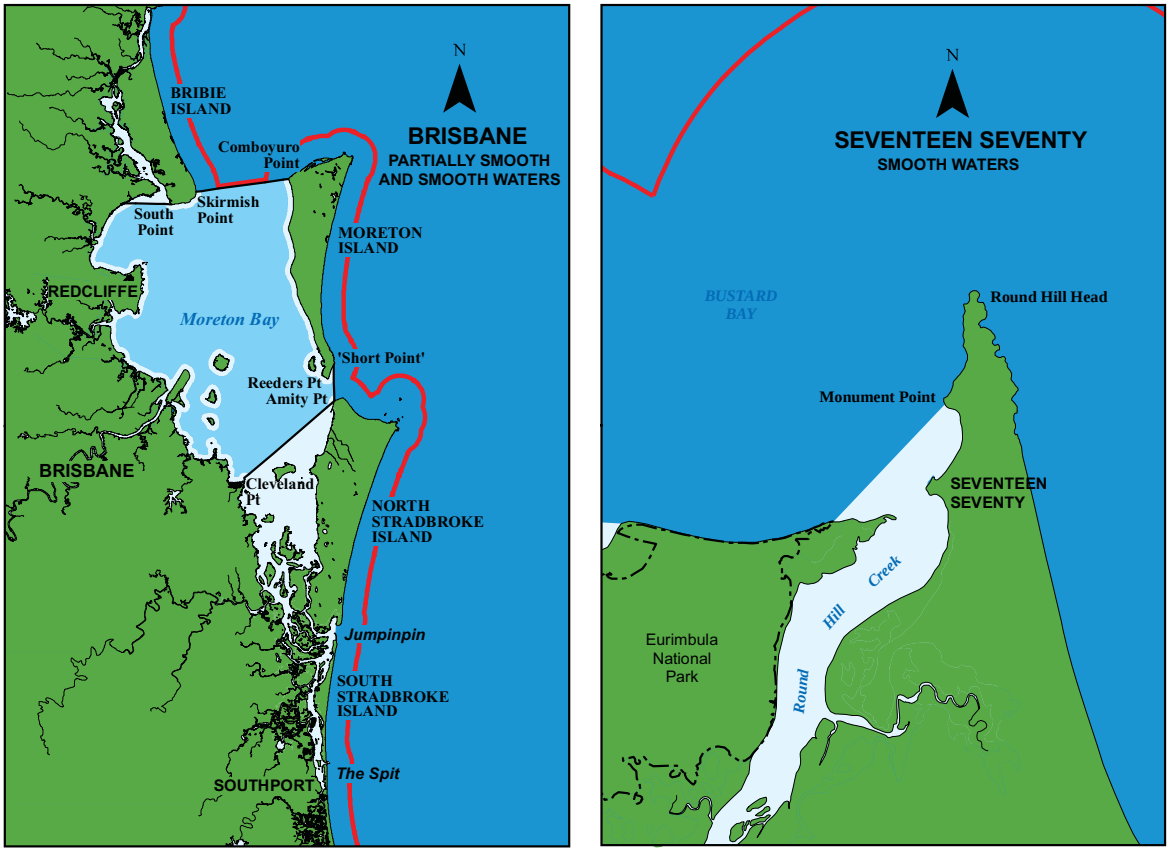
- Smooth waters — include rivers, creeks, streams and lakes; waters within breakwaters or revetments; and within half a nautical mile from land within partially smooth waters and other waters specified in legislation.
- Partially smooth waters — are determined by Maritime Safety Queensland and are specified in legislation.
- Beyond smooth and partially smooth waters — areas beyond these limits.

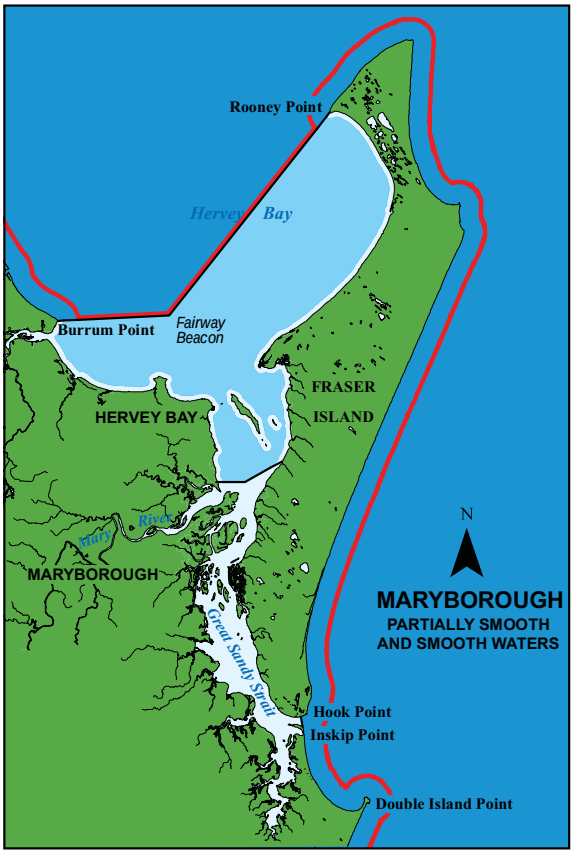
A complete list of maps showing these areas follows.

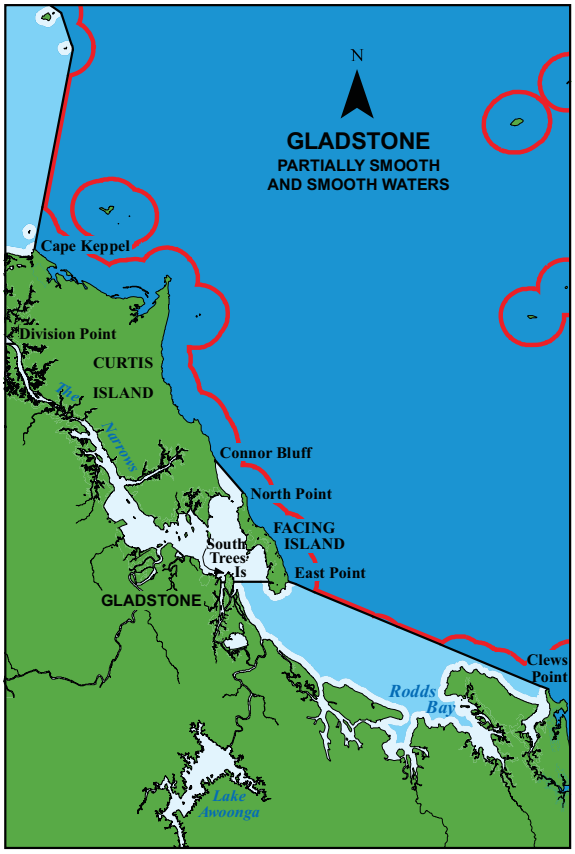
Legend

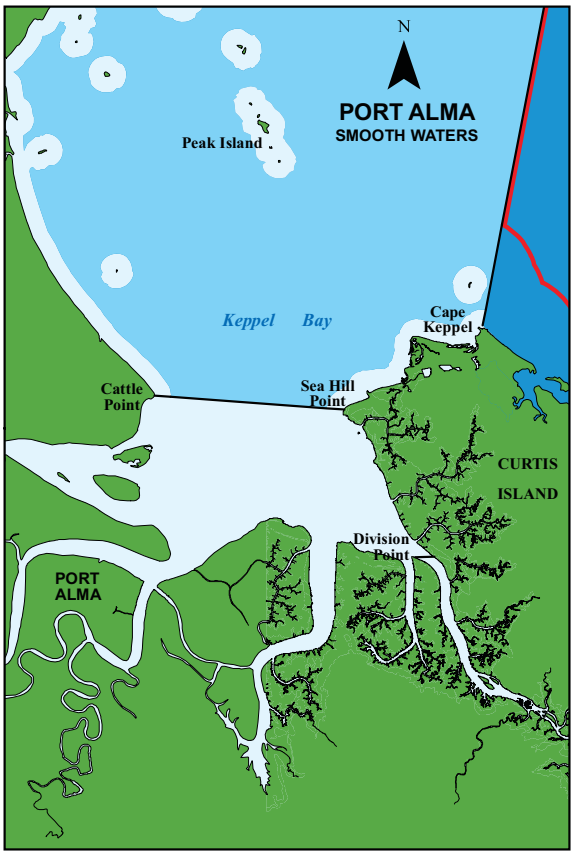
Smooth waters Partially smooth waters Beyond smooth and partially smooth waters

The red line designates limits beyond which EPIRBs must be carried.




Rooney Point
Hervey Bay
Burrum Point
Fairway Beacon
FRASER ISLAND
HERVEY BAY
Mary River
MARYBOROUGH
Great Sandy Strait
Hook Point
Inskip Point
Double Island Point
N
MARYBOROUGH
PARTIALLY SMOOTH AND SMOOTH WATERS


N
GLADSTONE
PARTIALLY SMOOTH AND SMOOTH WATERS
Cape Keppel
Division Point
CURTIS ISLAND
Rock
Narrows
Connor Bluff
North Point
FACING ISLAND
South Trees Is
East Point
GLADSTONE
Clews Point
Rodds Bay
Lake Awoonga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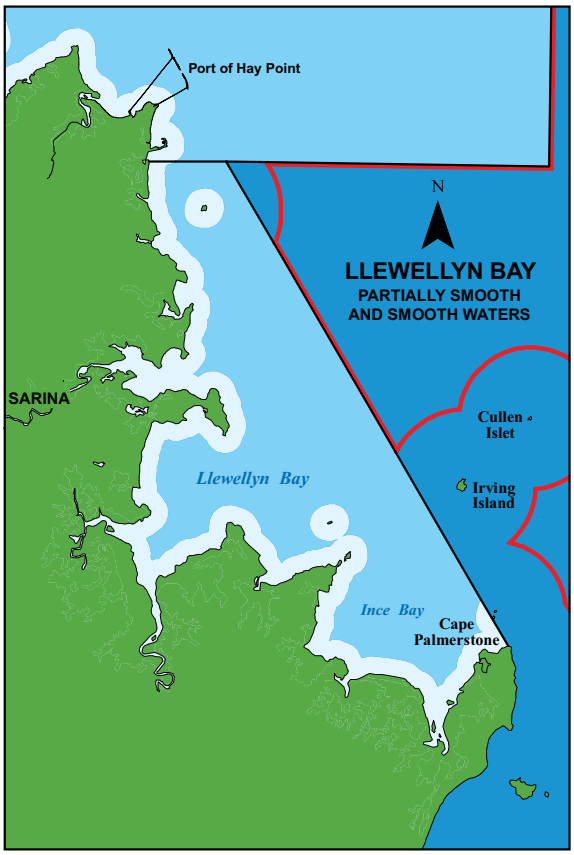
PORT ALMA
SMOOTH WATERS
Peak Island
Keppel Bay
Cape Keppel
Cattle Point
Sea Hill Point
CURTIS ISLAND
Division Point
PORT ALMA


Port of Hay Point
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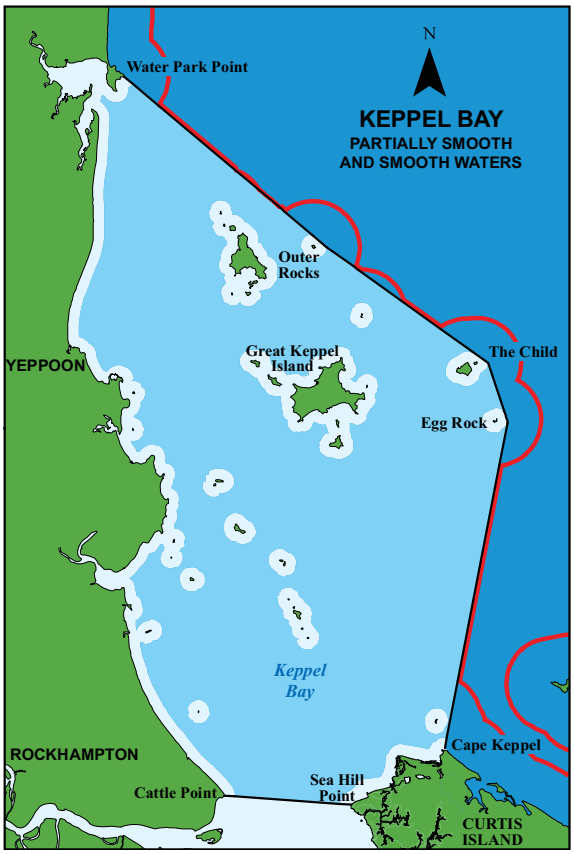
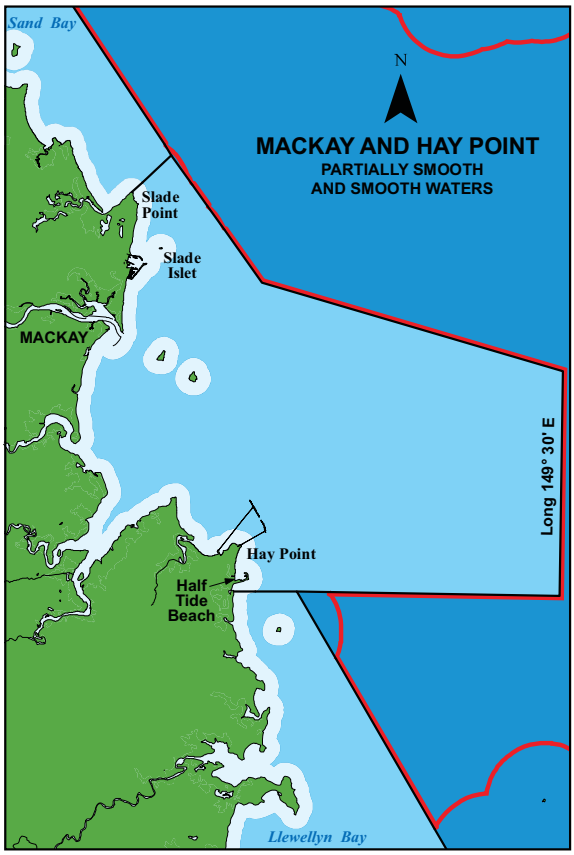
LLEWELLYN BAY
PARTIALLY SMOOTH AND SMOOTH WATERS
SARINA
Cullen Islet
Irving Island
Llewellyn Bay
Ince Bay
Cape Palmerstone


N
KEPPEL BAY
PARTIALLY SMOOTH
AND SMOOTH WATERS
Water Park Point
Outer
Rocks
Great Keppel
Island
The Child
YEPPOON
Egg Rock
Keppel
Bay
ROCKHAMPTON
Cape Keppel
Cattle Point
Sea Hill
Point
CURTIS
ISLAND


Sand Bay
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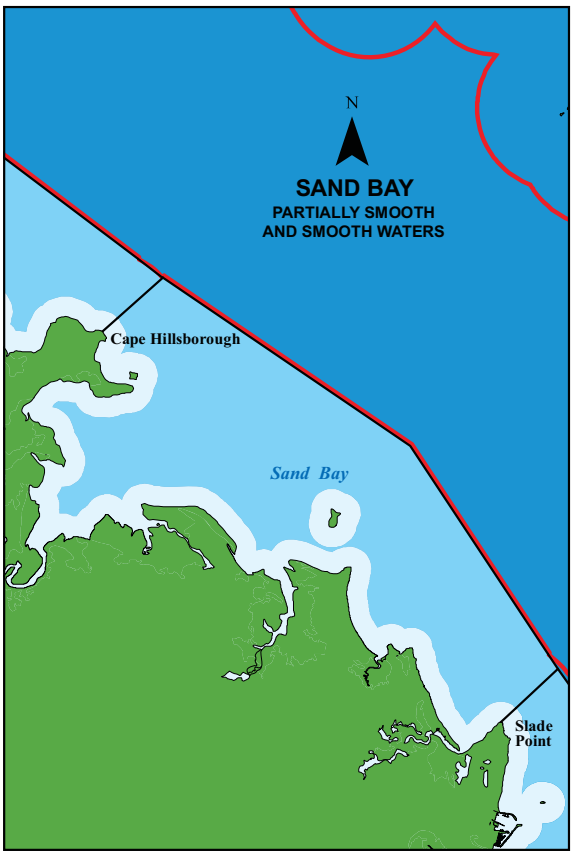
MACKAY AND HAY POINT
PARTIALLY SMOOTH
AND SMOOTH WATERS
Slade
Point
Slade
Islet
MACKAY
Long 149° 30' E
Hay Point
Half
Tide
Beach
Llewellyn Bay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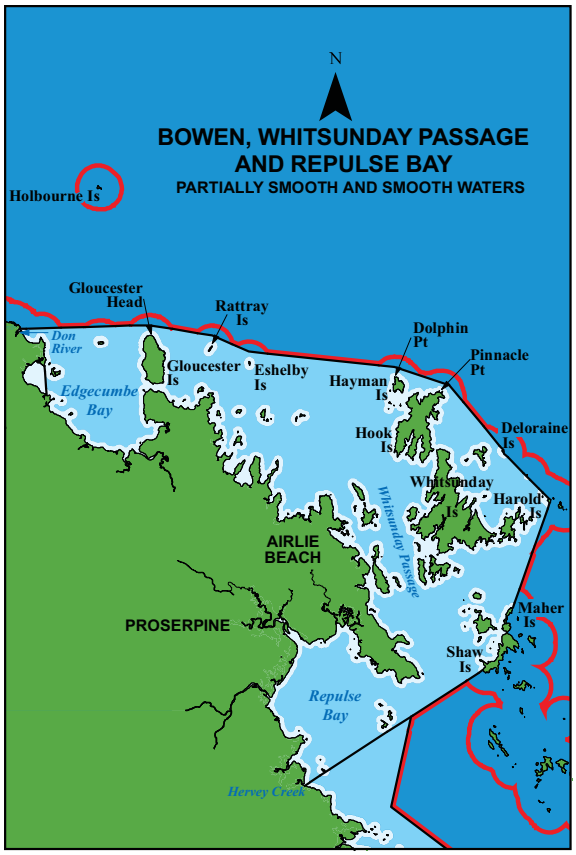
AND SMOOTH WATERS
Cape Hillsborough
Sand Bay
Slade
Point


N
BOWEN, WHITSUNDAY PASSAGE
AND REPULSE BAY
PARTIALLY SMOOTH AND SMOOTH WATERS
Holbourne Is
Gloucester
Head
Rattray
Is
Don
River
Dolphin
Pt
Pinnacle
Pt
Gloucester
Is
Eshelby
Is
Hayman
Is
Edgecumbe
Bay
Hook
Is
Deloraine
Is
Whitsunday
Is
Harold
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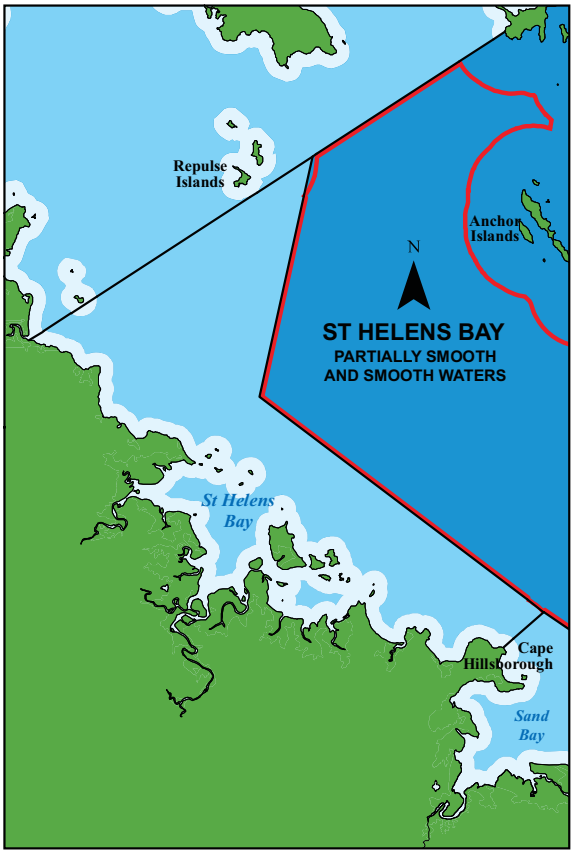
AIRLIE
BEACH
Maher
Is
PROSERPINE
Shaw
Is
Repulse
Bay
Hervey Creek


Repulse Islands
Anchor Islands
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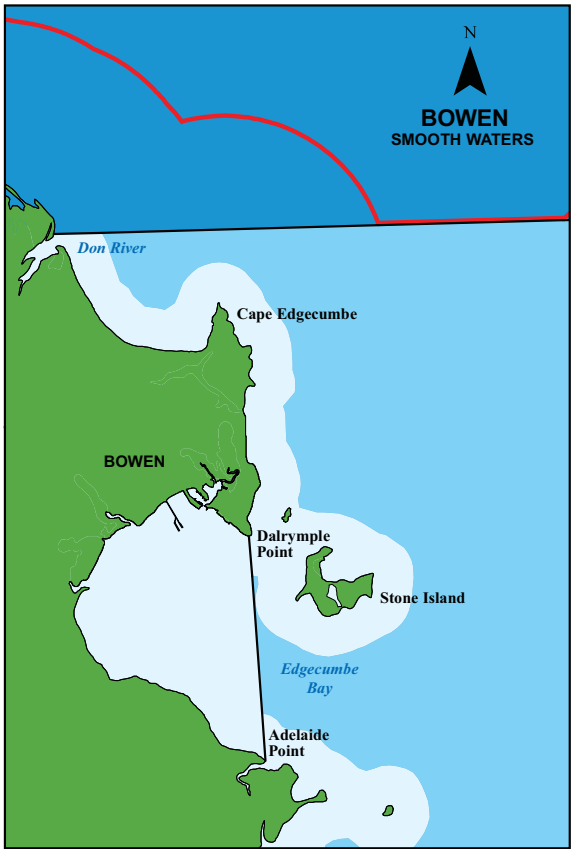
ST HELENS BAY
PARTIALLY SMOOTH AND SMOOTH WATERS
St Helens Bay
Cape Hillsborough
Sand Bay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SMOOTH WATERS
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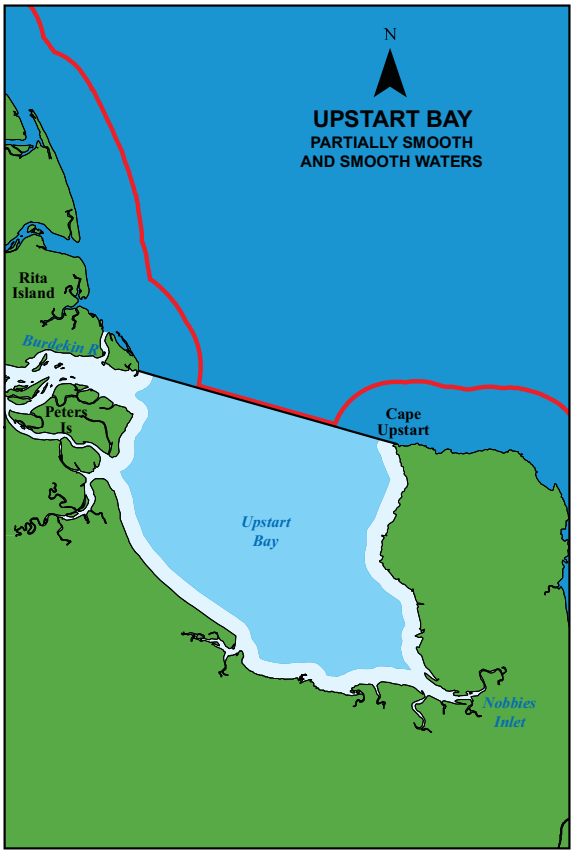
Cape Edgecumbe
BOWEN
Dalrymple Point
Stone Island
Edgecumbe Bay
Adelaide Point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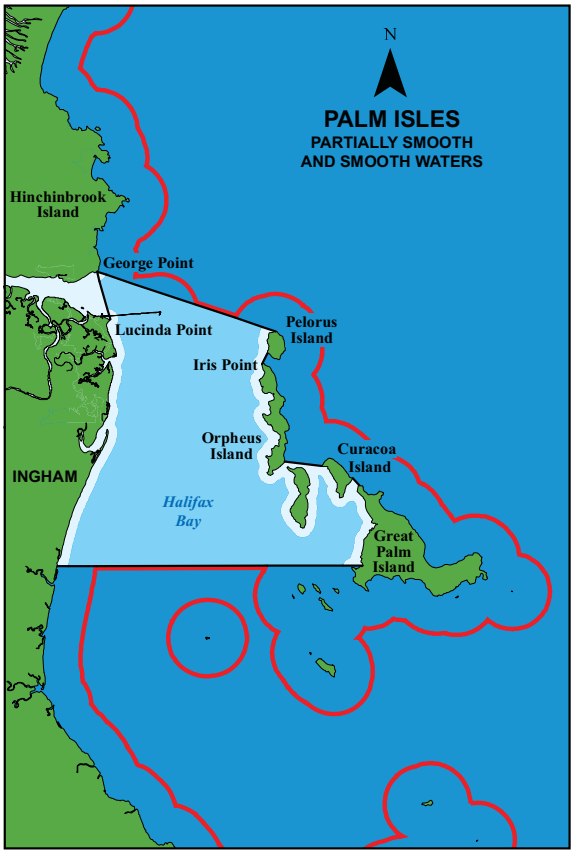
PARTIALLY SMOOTH AND SMOOTH WATERS
Rita Island
Peters Is
Cape Upstart
Upstart Bay
Nobbies Inlet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PARTIALLY SMOOTH AND SMOOTH WATERS
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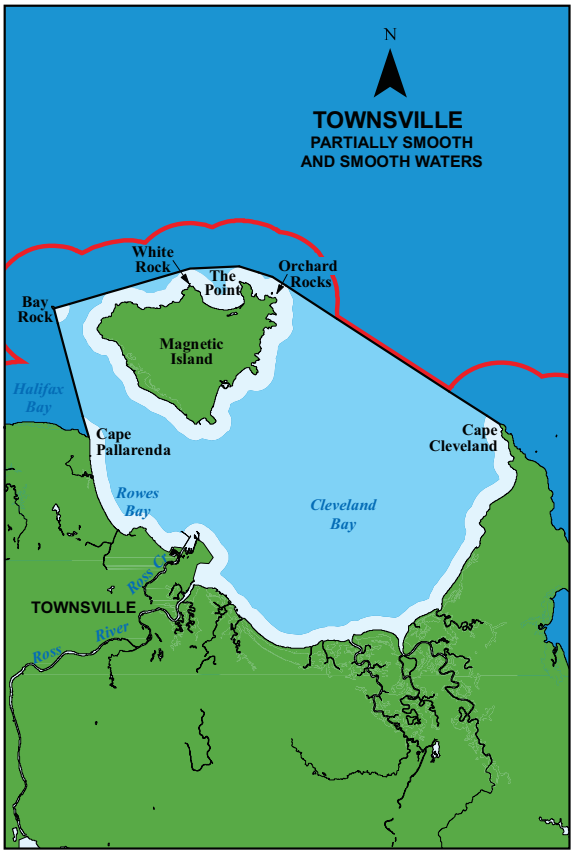
Curacoa Island
INGHAM
Halifax Bay
Great Palm Island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PARTIALLY SMOOTH
AND SMOOTH WATERS
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Rowes Bay
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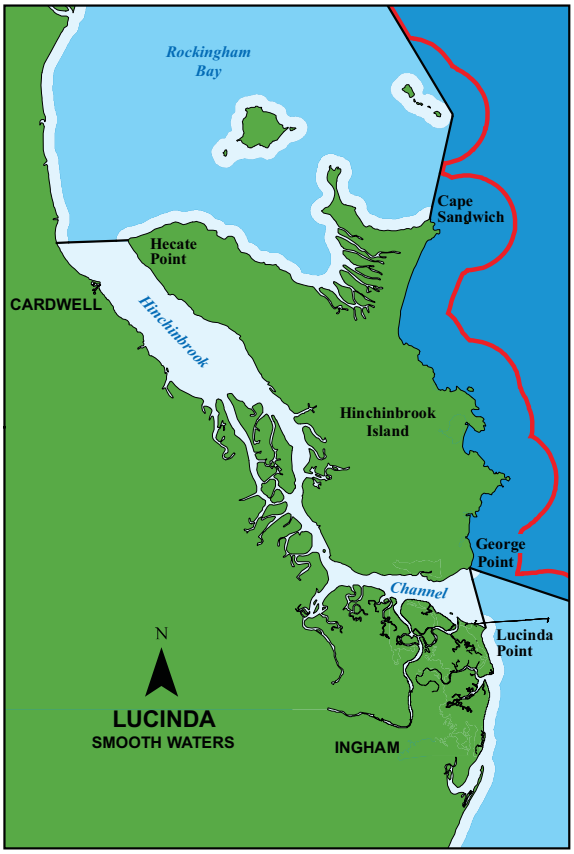
TOWNSVILLE
Ross River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Hinchinbrook
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Channel
Lucinda Point
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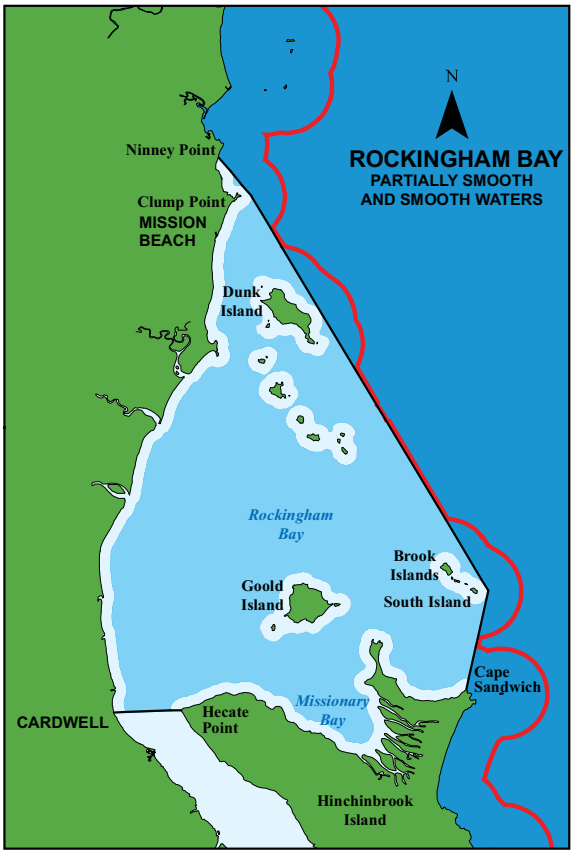
SMOOTH WATERS
INGHAM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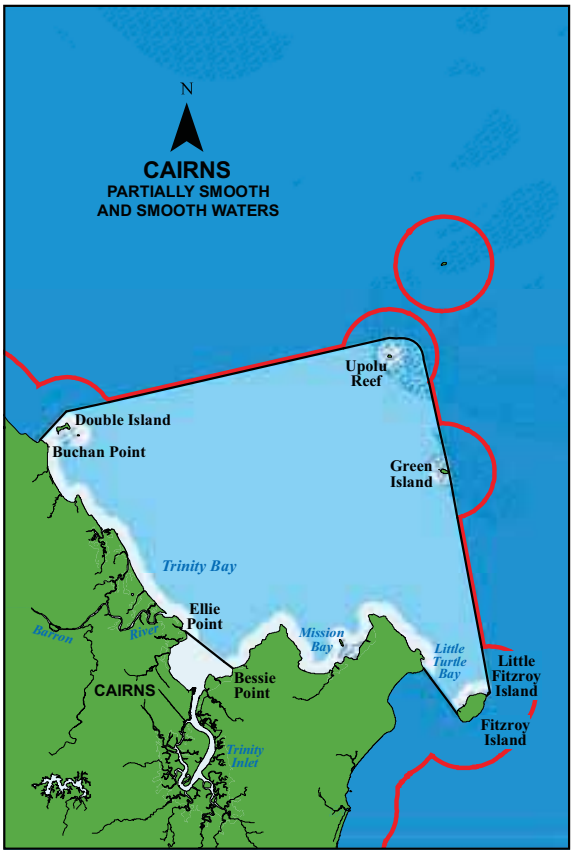
ROCKINGHAM BAY
PARTIALLY SMOOTH
AND SMOOTH WATERS
Ninney Point
Clump Point
MISSION BEACH
Dunk Island
Rockingham Bay
Brook Islands
Goold Island
South Island
Cape Sandwich
Missionary Bay
CARDWELL
Hecate Point
Hinchinbrook Island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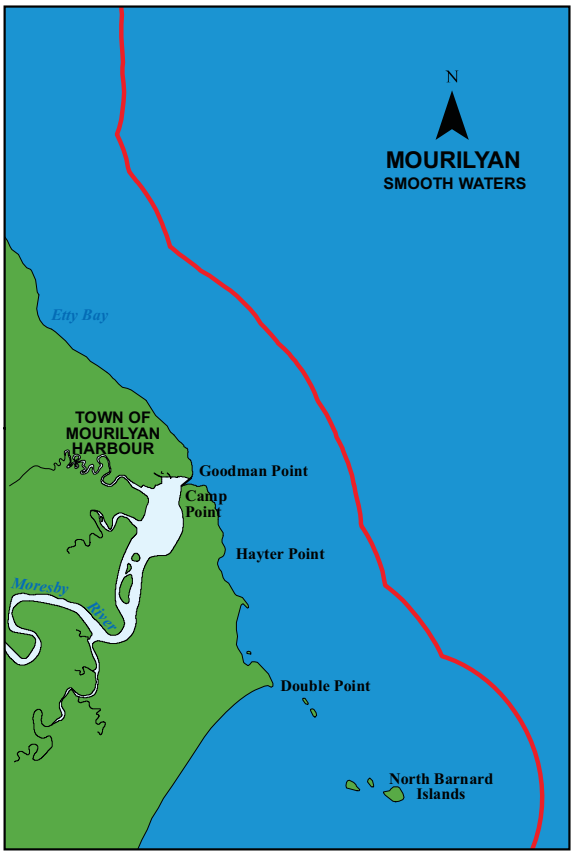
PARTIALLY SMOOTH
AND SMOOTH WATERS
Upolu Reef
Double Island
Buchan Point
Green Island
Trinity Bay
Ellie Point
Barron River
Mission Bay
Little Turtle Bay
Little Fitzroy Island
CAIRNS
Bessie Point
Fitzroy Island
Trinity Inlet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MOURILYAN
SMOOTH WATERS
Etty Bay
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MOURILYAN
HARBOUR
Goodman Point
Camp
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Hayter Point
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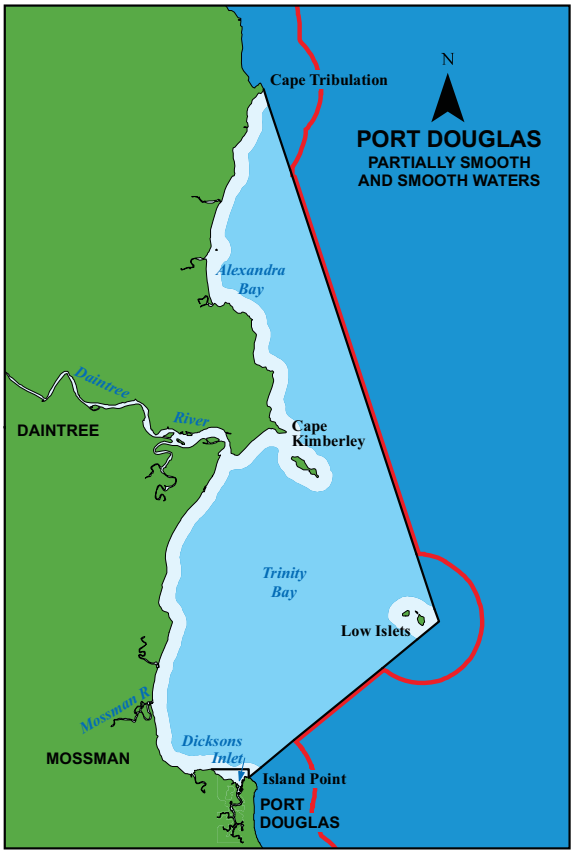
River
Double Point
North Barnard
Islands


Cape Tribulation
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PORT DOUGLAS
PARTIALLY SMOOTH
AND SMOOTH WATERS
Alexandra
Bay
Daintree
River
DAINTREE
Cape
Kimberley
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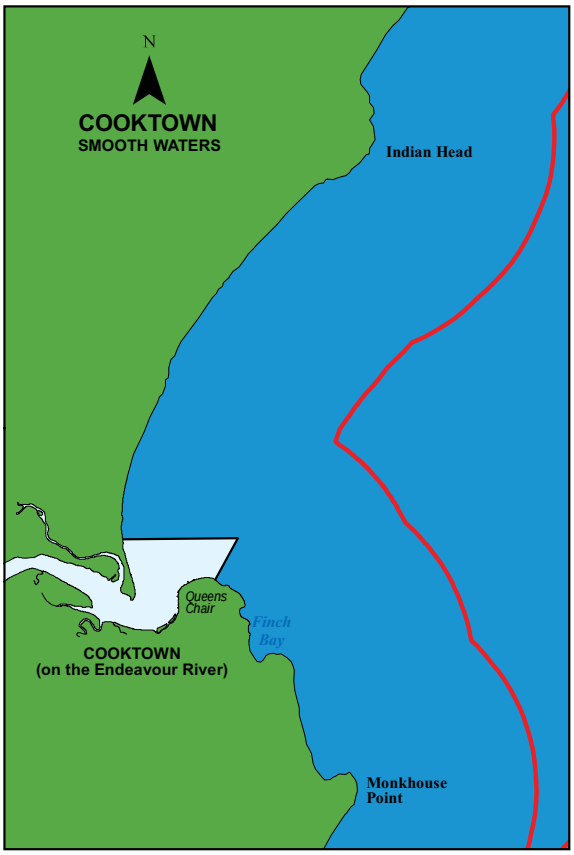
Mossman R.
Dicksons
Inlet
MOSSMAN
Island Point
PORT
DOUGLAS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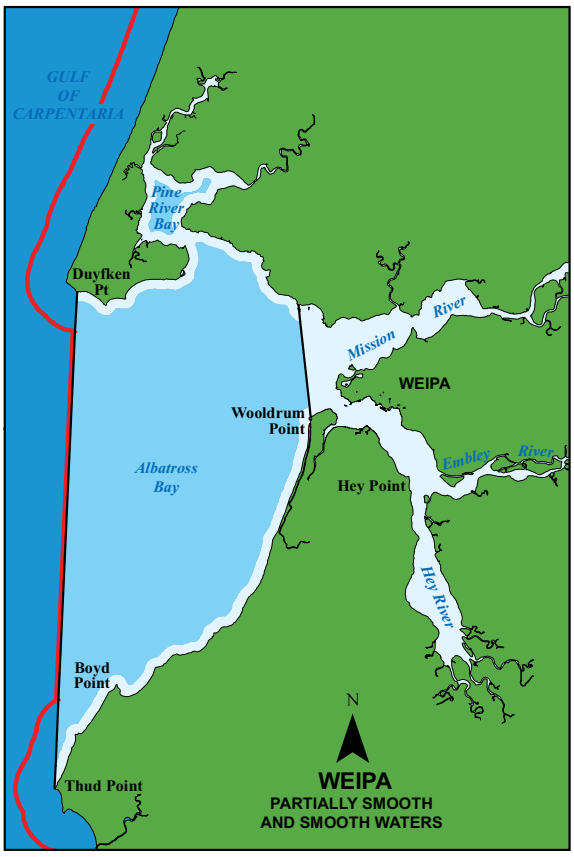
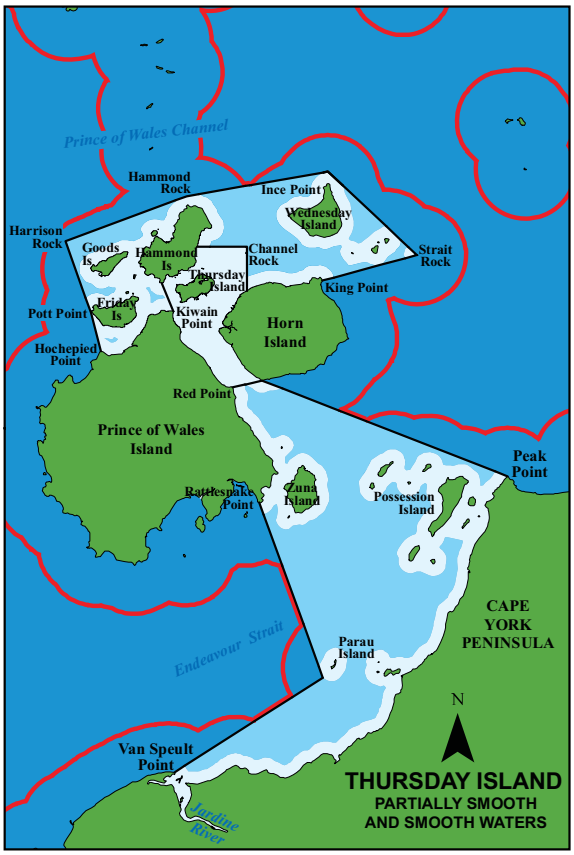
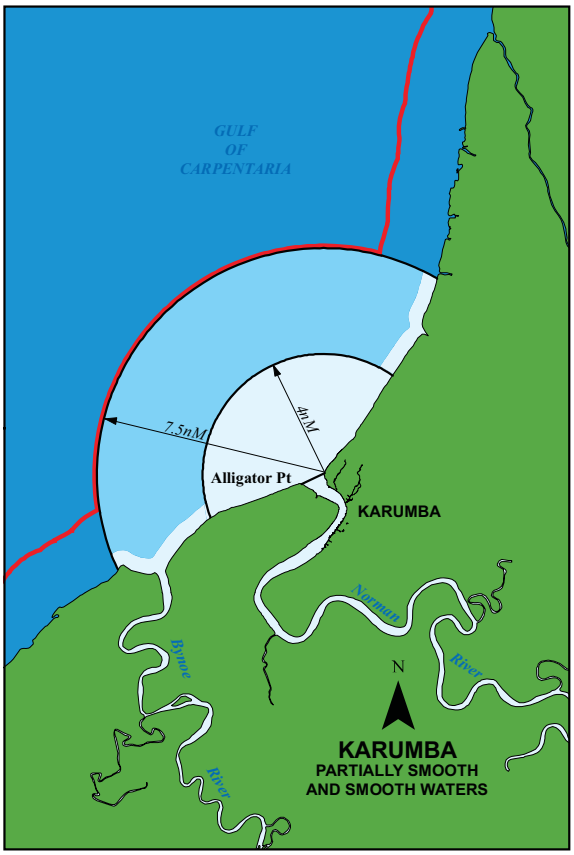
COOKTOWN
SMOOTH WATERS
Indian Head
Queens
Chair
Finch
Bay
COOKTOWN
(on the Endeavour River)
Monkhouse
Point


GULF
OF
CARPENTARIA
Pine
River
Bay
Duyfken
Pt
River
Mission
WEIPA
Wooldrum
Point
Albatross
Bay
Emblev
River
Hey Point
Hey River
Boyd
Point
N
WEIPA
PARTIALLY SMOOTH
AND SMOOTH WATERS
Thud Point


Prince of Wales Channel
Hammond Rock
Ince Point
Wednesday Island
Harrison Rock
Goods Is
Hammond Is
Channel Rock
Strait Rock
Thursday Island
King Point
Pott Point
Friday Is
Kiwain Point
Horn Island
Hochepied Point
Red Point
Prince of Wales Island
Peak Point
Rattlesnake Point
Zuna Island
Possession Island
CAPE YORK PENINSULA
Endeavour Strait
Parau Island
N
Van Speult Point
THURSDAY ISLAND
PARTIALLY SMOOTH AND SMOOTH WATERS
Jardine River


GULF OF CARPENTARIA
7.5nM
4nM
Alligator Pt
KARUMBA
Nernan River
Byno River
N
KARUMBA
PARTIALLY SMOOTH AND SMOOTH WATERS

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