5
EFFECTS ON RECREATION AND TOURISM

September 2016 Final

Rob Greenaway & Associates

Lyttelton Port Company Channel Deepening Project and Maintenance Dredging

Assessment of Effects on Recreation and Tourism

Lyttelton Port Company
Channel Deepening Project and Maintenance Dredging

Assessment of Effects on Recreation and Tourism

Prepared for Lyttelton Port Company
by Rob Greenaway & Associates
www.greenaway.co.nz

8 September 2016

Version status: Final

Contents

List of Figures

1 Introduction and summary

This report reviews the potential effects of a proposal by the Lyttelton Port Company Limited (LPC) to deepen and extend the Lyttelton Harbour / Whakaraupō navigation channel to cater for deep-draught (14.5 m) commercial vessels ('Channel Deepening Project'), and to maintain that depth via maintenance dredging. Spoil from the initial 'capital dredging' is proposed to be deposited at an offshore dumping site 6 km beyond the harbour heads (the 'capital ground'), with maintenance dredge spoil to be deposited 3 km off Godley Head, rather than within the Harbour near Godley Head as currently occurs (the 'maintenance ground').

For a full description of the activities, location and methodologies proposed as part of the Channel Deepening Project refer to Section Two (Project Description) of the Assessment of Environmental Effects.

This assessment is based on literature review, consultation carried out by LPC since 2008 and by reference to independent technical assessments carried out for LPC on the potential effects of the proposal on biota and water quality.

Lyttelton Harbour / Whakaraupō is a regionally popular recreation setting, supporting swimming, sailing and many other forms of boating. Commercial recreation and tourism is limited to several small boat charter operators, including the historic tug Lyttelton and the regular ferry and charter operations of Black Cat Cruises.

Fishing is a popular use of the Harbour and nearby coast, but is of low quality compared with most other settings nationally due to a limited range and number of target species. Fishing away from the coast relies on access well-beyond (approximately 50 km offshore) the proposed offshore capital spoil dumping site (6 km offshore). Some diving and snorkelling occurs in and around the outer harbour and nearby coast, and paua, mussels and crayfish are taken at specific sites. Naturally high levels of turbidity limit the availability and quality of these activities. Swimming is popular at sites with relatively sandy beaches, such as at Cass and Corsair Bays, despite poor water clarity. Other bays on the southern side of the Harbour inside Adderley Head are popular day-trip destinations for boaters. Anchorage sites are identified at many locations in the harbour where depth allows, and depending on wind conditions. This includes anchorages within the spoil grounds currently used by LPC for maintenance dredging. The shoreline provides many terrestrial recreation opportunities, including those walking, heritage and sightseeing opportunities at Godley and Adderley Head, Ripapa and Quail Islands, Diamond Harbour and the road-accessible bays stretching from Naval Point at Lyttelton to Camp Bay east of Purau. Surfing is popular at Taylors Mistake, Sumner and along the Brighton shore.

Potential effects of the proposal of interest to recreation and tourism relate to:

- Turbidity effects (swimming, visual amenity)
- Effects on marine mammals and birds (tourism, boating)
- Effects on fin- and shellfish (fishing and diving)
- Changes to wave and current patterns (boating and beach activities, including surfing)
- Activity of commercial vessels (wakes and effects on boating)

Relevant technical assessments indicate little adverse effects on biota, turbidity and shoreline processes; largely due to:

- naturally high turbidity and limited potential for the proposed activities to increase turbidity or deposit sediment in areas used for recreation;
- the distance of the offshore spoil grounds;

- limited and localised effects on tide and current;
- minor changes to wave energy (discussed further immediately below);
- the normal behaviour of Hectors dolphins and their acclimatisation to commercial vessels and dredging;
- limited potential for effects on birds, and
- limited effects on fin- and shellfish and rapid recovery rates for disturbed biota.

The proposal will result in higher encounter rates between recreational and commercial vessels with the dredge in place. This is a normal interaction in a commercial port. While the Project will result in increased shipping efficiencies, shipping activity is projected to increase regardless with normal port activities over time. Larger ships do not generate larger wakes because they travel at very slow speeds when inshore.

The deeper and longer channel is projected to result in a 15% decrease in wave energy in the mid-section of the harbour, and this may result in a positive effect for small boat recreation. These effects are limited to long-distance swell waves which are modified in direction and energy levels (and therefore height) due to changes in bathymetry on the harbour floor as well as at the maintenance and capital spoil disposal grounds. Effects on 'sea waves' generated by local winds are slight. There may be increased wave effects at the bays in the outer Harbour, particularly in the south, but not enough to affect shoreline processes. It is likely that effects on waves will be difficult to discern, and when relevant swell waves are acting in the outer harbour, inshore recreational boating activity will be naturally unattractive. Effects on surf waves north of Godley Head will be imperceptible with very small increases and decreases in wave height, or no change, depending on wave direction. Changes to currents in the harbour (strength and direction) are minor.

The net effect on recreation and tourism is likely to be minor or less and very similar to the status quo.

1.1 Method

This assessment is largely a desk-top study based on available data via:

- Popular published recreation guides and studies of recreation and tourism values of the study area (see references),
- On-line (world-wide-web) discourse about recreation and tourism in the study area,
- Consultation findings completed by LPC and its consultants since 2008 with regard to the proposals,
- Review of technical reports prepared for LPC in relation to, in the main, ecological effects of dredging and spoil disposal. These reports are detailed in the references and include assessments of changes to, or effects on:
    - sediment and turbidity within the Harbour and in and around the spoil grounds,
    - waves and tides within the Harbour and along the open coastline,
    - birds,
    - marine mammals,
    - coastal processes, and
    - fish and shellfish and other mahinga kai species.

2 Recreation and tourism data

This section reviews secondary data which describes the recreation and tourism values of the study area. The first two sections give some general background information on marine recreation in New Zealand and Canterbury and the remaining sections focus on specific activities in and around Lyttelton Harbour / Whakaraupō.

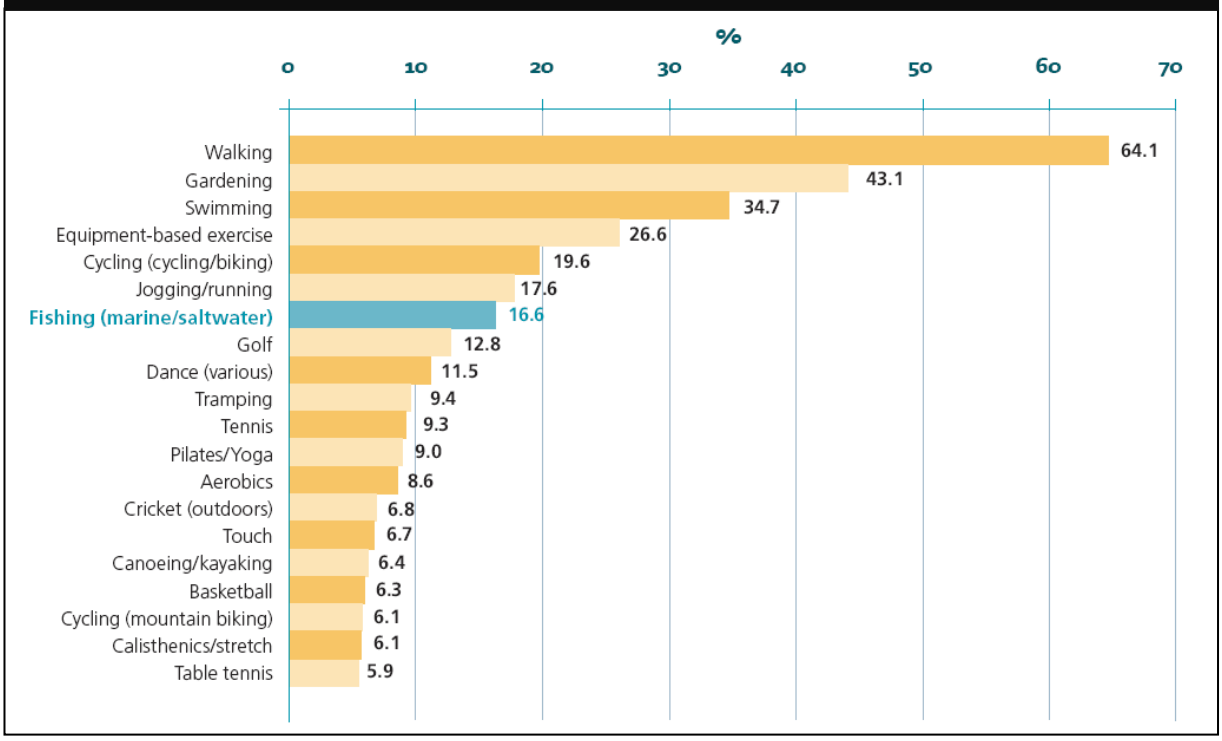
2.1 Marine recreation participation

Various estimates are available for the number of marine fishers in New Zealand. Kearney (2002) reviews various studies which have given a wide range for the level of participation. These include estimates based on surveys carried out between 1996 and 2000 ranging from 9.7% to 39% of the population (Reilly 2002 in Kearney 2002).

At the national level, reliable relative data (if not absolute)[1] are provided by the Active NZ Surveys carried out by Sport New Zealand (previously SPARC – Sport and Recreation NZ) (SPARC 2009a, 2015). The data from the most recent studies (2007/08 and 2013/14) are based on a stratified (by time and location) national respondent set of just over 4,400 and 6,400 adults aged over 16 respectively. The 2007/08 results showed that 19.3%[2] of all New Zealand adults aged 16 years and over (633,768 people) had participated in fishing at least once; 16.6%[3] had participated in marine fishing (539,515 adults aged over 16) and 5.7%[4] had participated in freshwater fishing. This made marine fishing the 7th most popular form of active recreation in NZ in 2007/08 (Figure 1), while freshwater fishing was ranked 21st equal (with rugby union) (SPARC 2009b). Golf is the nation's most popular sport activity.

Active NZ survey data are available for each regional sports trust organisation (RSTO) area,

Figure 1: Sport and recreation activities with the highest participation levels (SPARC 2009b)



[1] SPARC (2009a) notes: "The Active NZ Survey is a nationally representative survey of all New Zealand adults. The findings in this profile are not directly comparable with other sources of information about fishing. This is because methodological differences (e.g. the way data is collected, the definitions used) contribute to differences in findings between different data sources."
[2] (95% CI: 17.7–21.2)
[3] (95% CI: 15.0–18.3)
[4] (95% CI: 4.6–6.8)

which in Canterbury includes the West Coast. This means that any regional data are not representative of Christchurch City. However, for the Canterbury-West Coast RSTO, fishing participation was lower than the national average at 13.5% of the adult population compared with 19.3% for New Zealand (SPARC 2009c).

The 2013/14 results were only available in summary format at the date of this report and do not provide a breakdown by marine and freshwater activity. They also do not include the very popular activity of gardening, and so comparison across the years is difficult. However, fishing participation was shown in this more recent survey as the fifth most popular activity nationally at 19.5%, having over-taken jogging and running; and the third most popular activity for Maori. For men, fishing was the second-most popular form of recreation (29.2% participation), and for women, the ninth (10.5%).

At the national level, 3.8% of the population reported going diving in 2007/8, and in 2013/14 the figure was 3.4%; and 2.4% went sailing or yachting, and in 2013/14 the figure was 2.1%. Canoeing and kayaking also showed a growth in popularity between the surveys (from 6.3% to 8.2%) (SPARC 2009b & Sport NZ 2015). This does not include the use of stand-up paddle boards, but does include sea kayaks and sit-upons.

The Active NZ surveys only consider physically active, non-motorised pursuits and so did not review motor boating participation.

Surfing and bodyboarding[5] were undertaken by 4.3% of the population in 2013/14, with no change from 2007/08 (Sport NZ 2015 & 2013). Between 1997/98 and 2007/08 participation in surfing and body boarding by young adults (18-24 year olds) was reported to have decreased by almost a half (16% to 8.6%), but was stable for other age groups (Sport NZ 2013). The Gemba Group (2013) reported a regional range for surfing participation of 7% in Northland and 6% in the Bay of Plenty, to 2% in each of Wellington, Manawatu/Wanganui, Canterbury/West Coast and Otago (and inadequate data in Tasman for reporting).

Kalafatelis & Magill (2013) completed a national survey of recreational boating activity for Maritime NZ with 1500 respondents. The results do not appear to have been filtered for marine activity only. This indicated, at the national level, that 24% of New Zealanders aged over 18 owned or use a vessel for recreation boating purposes (57% male and 43% female):

- 15% own or use a canoe or kayak,
- 9% own or use a power boat under 6m,
- 9% own or use a dinghy,
- 5% own or use a power boat over 6m,
- 3% own or use a sail boat under 6m,
- 2% own or use a sail boat over 6m,
- 2% own or use a jet ski.

During periods when boaties are ‘most active’, such as over summer, 24% of users of power boats under 6m went boating at least weekly, and another 25% went out once every couple of weeks. Similar levels of activity were evident for other vessels, but power boats under 6m were the most frequently used.

The average number of years of boating experience was 12.9 years, with those owning or using kayaks and canoes the least experienced.

[5] These activities are combined in the Active NZ activity sets.

Kalafatelis & Magill (2013) reported the ownership of types of vessel by region, but the levels of response by subgroup was not high and there is limited reliability in the data.

Vance (2014) used the data gathered by Kalafatelis & Magill (2013) and older information to review trends in boat ownership. Eight Colmar Brunton surveys completed between 2002 and 2011 gave a range of 16% to 19% of households owning at least one boat in New Zealand; or 641,000 people and 727,000 vessels. Kalafatelis & Magill (2013) gave an estimate of 900,000 vessels. Vance (2014) estimates that between 30% and 50% of boat users go out at least every couple of weeks; and that levels of ownership have been reasonably consistent since at least 2006, but with possible increases in the ownership of trailer power boats and canoes and kayaks. However, the use of different survey methods means these trends are not certain.

2.2 Marine recreation activity distribution in Lyttelton Harbour / Whakaraupō

A survey of recreation use of 15 marine structures over the 2013/14 summer administered by the Christchurch City Council (CCC) included the Lyttelton public ramp and jetty at Naval Point (Greenaway 2014). This site, with 135 respondents, indicated the following main recreational uses of the Harbour by ramp users (in descending order of frequency): boating generally, fishing, biscuiting, water skiing, picnics, swimming, and wake and knee boarding. Most ramp users had power boats (76%), but jet skis were also popular (15%), and yachts made up 6% of vessels launched. Three quarters of respondents were from Christchurch and all were from Canterbury. The survey did not include users of the Naval Point Club ramp. The Cass Bay ramps were less frequently used and were popular sites for kayak launching (55% of respondents). The Charteris Bay slipway was used mostly by power boats, jet skis and kayaks, as well as wind surfers and paddle boarders. The launching facilities at Purau were used most to access the locally-moored boats, but also for jet skiing and to access other swimming, sailing and fishing sites in the harbour. The facilities on the southern side of the harbour were more likely to be used by local harbour residents.

The Department of Conservation's revised draft and operative Canterbury Conservancy Conservation Management Strategies (DOC 2014, 2004) offer little information about the recreational values of Lyttelton Harbour / Whakaraupō, and focuses on the management of Ripapa and Quail Islands for a variety of values (including recreation) and the Godley Head Farm Park and Adderley Head Scenic Reserve (see Figure 11 on page 23). Of Banks Peninsula generally, the operative CMS (DOC 2004) states (p54):

> *Motor camps and baches around the peninsula boost population numbers markedly over long weekends and holiday periods. Recreational activities are predominantly located in coastal areas and include fishing, shellfish gathering, boating, swimming, rock climbing and walking. Short walks through the reserves, the walkway network and, more recently, longer tramps over private farmland with accommodation provided are popular.*

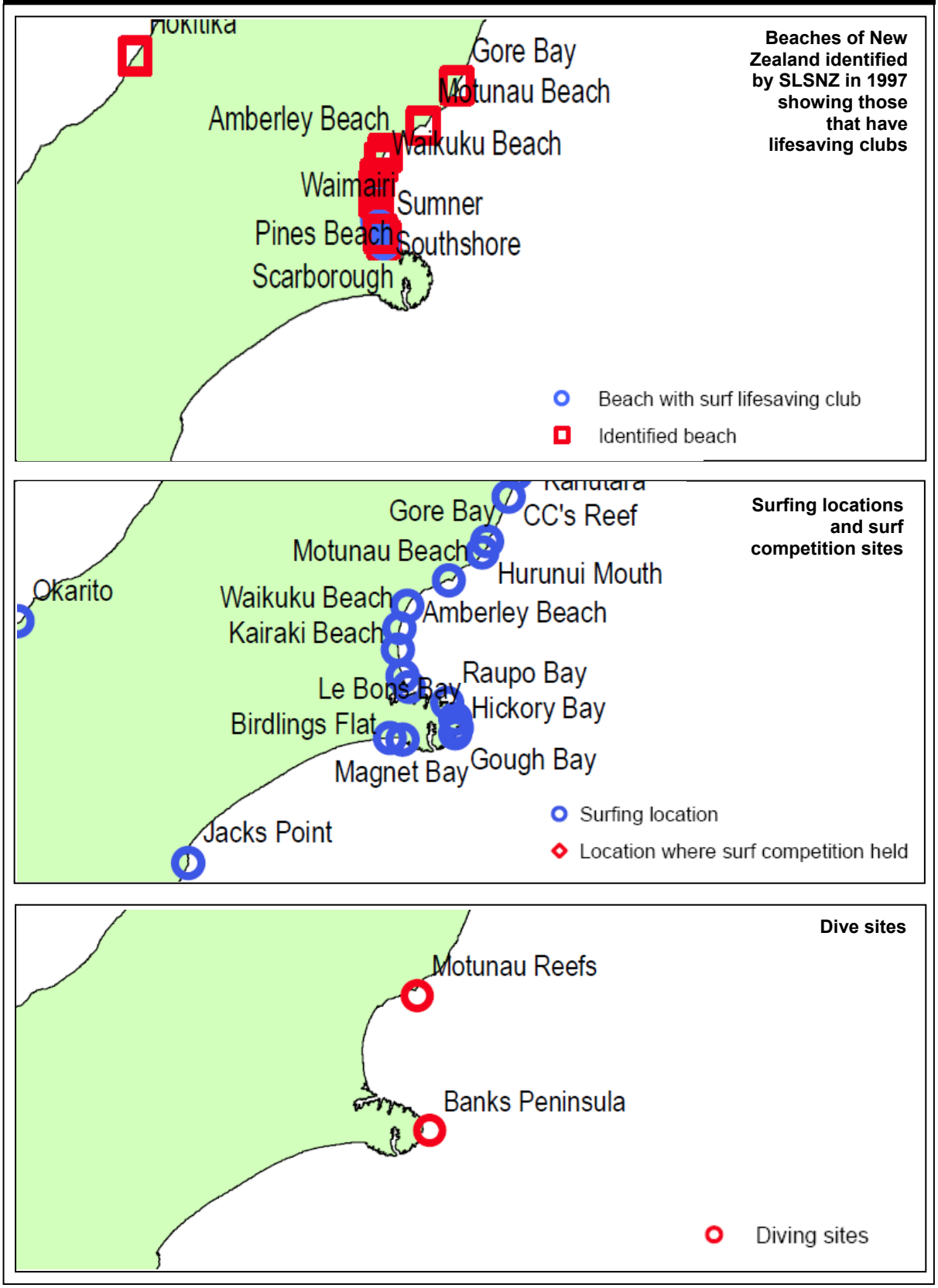
The revised draft CMS notes (p52):

> *As well as being home to its residents, the Peninsula is often regarded as an accessible recreation area at the 'backdoor' of Christchurch City. Visitor use of the Peninsula, however, needs to be viewed in the context of other recreational opportunities within Canterbury reached in similar travel times from Christchurch. The Port Hills, Lyttelton and Akaroa Harbour basins, Little River and some Eastern Bays provide intensively used areas, but elsewhere quite remote settings can still be experienced.*

The Department's 1990 *Coastal Resource Inventory (First Order Survey) for Canterbury* (Russell 1990) identifies four settings in the Harbour with 'human modification and use':

- Lyttelton Harbour / Whakaraupō mudflats: *Recreational boaters in Governors and Charteris Bays. Mudflats extend up to roadside so no attraction for active recreation….This is one of the most accessible points for the public to view the coast. Flounder fishing occurs.*
- Quail Island / King Billy Island: *Some jetties and moorings used, popular by boaties.*

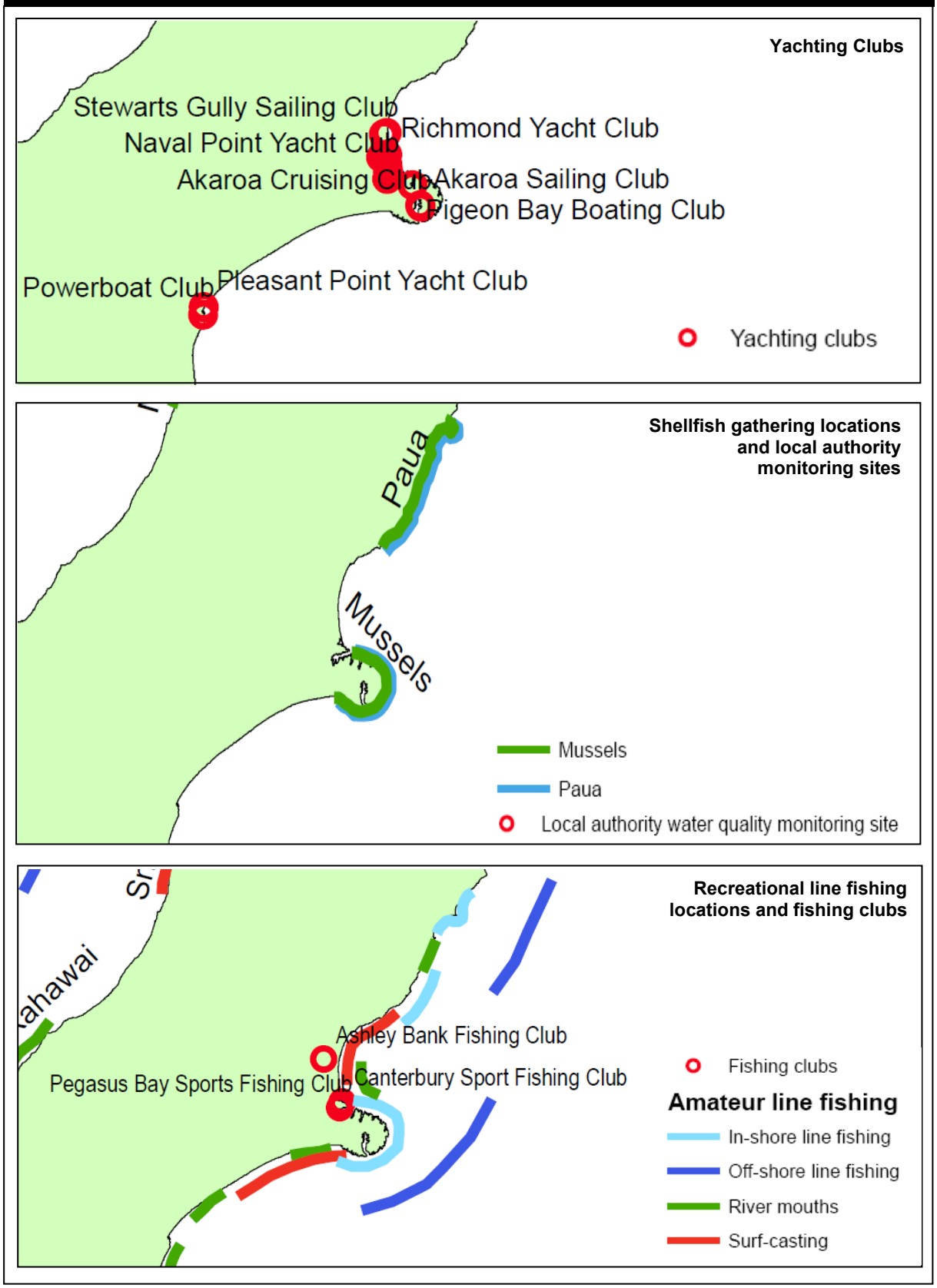
Figure 2: Beaches, surfing sites and diving sites from Allen *et al* 2009



Water ski lane – southeast side.

- Ripapa Island / Wreck and Pile Bays: *Used as HQ for Navy League and tourist venture – considerable recreational and historical use. Wreck and Pile Bay(s) considerably used by boat owners – water ski areas laid out. Popular swimming beaches.*
- Camp Bay – Adderley Head: *Camp Bay is a popular weekend destination, safe*

Figure 3: Yacht clubs, shellfish gathering, water monitoring, recreational fishing from Allen *et al* 2009



swimming beach. Quarantine station is important and easily accessible historical feature of the harbour. Little Port Cooper is popular for boaters and day trips, good anchorage – some native tree plantings. Paua and crayfish found.

Biosecurity New Zealand released a review of coastal social values in 2009 (Allen *et al* 2009). This indicated that, at the national level, there is only a very coarse understanding of the distribution of marine recreation. The study considered beach recreation, surfing, diving, boating and seafood gathering, but, in the main, only proxy information was used to identify where these activities occur – such as the presence of a surf living saving club to identify swimming locations or a yacht club for sailing. This resulted in broad descriptions of activity patterns, as shown in Figure 2 and Figure 3.

2.3 Fishing

The Spot X national fishing (Draper et al 2004), surfcasting (Draper & Airey 2012) and boat fishing (Airey 2012) guides identify limited fishing opportunities in and around Lyttelton Harbour / Whakaraupō. Figure 4 shows the only recommended shore-based fishing site in the Harbour from Draper & Airey (2012). The closest recommended alternative shore-based sites are to the north of Godley Head in Taylors Mistake and to the south in Akaroa Harbour. The text for Lyttelton describes it as "not a crash-hot fishing spot."

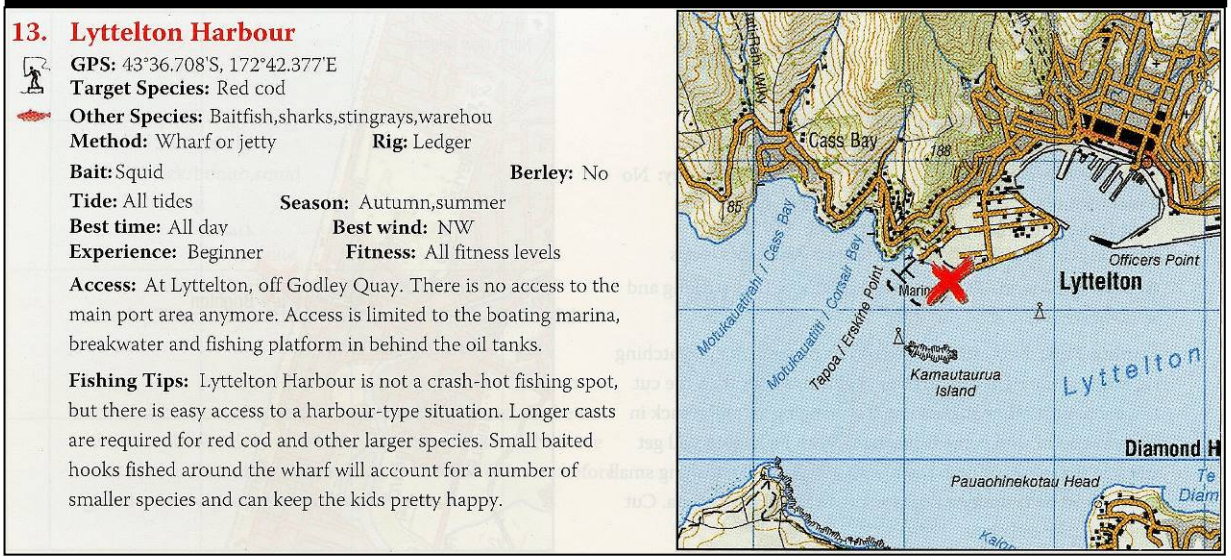
Figure 5 shows the recommendations for other fishing spots from Draper et al (2004). This includes more sites than in the more recent Spot X boat fishing guide (Airey 2012) which, near Lyttelton Harbour / Whakaraupō, includes one site in Taylors Mistake (site 5 for kingfish), a cray dive site nearby (site 6) and a kingfish site off the eastern side of the entrance to Port Levy / Koukourārata (Baleine Point).

Benn (2009) indicates recreational fishing values throughout the near-shore coastal environment of Banks Peninsula (Figure 6), but not in the mid-section of Lyttelton Harbour / Whakaraupō.

There are few online references to angling in Lyttelton Harbour / Whakaraupō, and these vary in their recommendations:

- A 2008 review of shore-based fishing in the South Island in NZ Fishing News[6] only recommends fishing off local wharves:

Figure 4: Surfcasting guide recommendation, Draper & Airey (2012)



13. Lyttelton Harbour

GPS: 43°36.708'S, 172°42.377'E
Target Species: Red cod
Other Species: Baitfish,sharks,stingrays,warehou
Method: Wharf or jetty **Rig:** Ledger
Bait: Squid **Berley:** No
Tide: All tides **Season:** Autumn,summer
Best time: All day **Best wind:** NW
Experience: Beginner **Fitness:** All fitness levels

Access: At Lyttelton, off Godley Quay. There is no access to the main port area anymore. Access is limited to the boating marina, breakwater and fishing platform in behind the oil tanks.

Fishing Tips: Lyttelton Harbour is not a crash-hot fishing spot, but there is easy access to a harbour-type situation. Longer casts are required for red cod and other larger species. Small baited hooks fished around the wharf will account for a number of smaller species and can keep the kids pretty happy.

[6] http://www.stuff.co.nz/sport/fishing/articles-reviews/fishing-saltwater/618142/A-Wonderful-Mainland-Challenge

In nearby Lyttelton Harbour, the Diamond Harbour Wharf is worth a go. In the summer ground-baiting and fishing with a float and small hooks is a good way to catch large yellowey mullet and garfish. At night, a whole, straylined mullet cast off any of the Lyttelton Harbour wharves is a good way to catch large stingray, which are best released upon capture.

Figure 5: Fishing guide recommendation, Draper et al (2004)

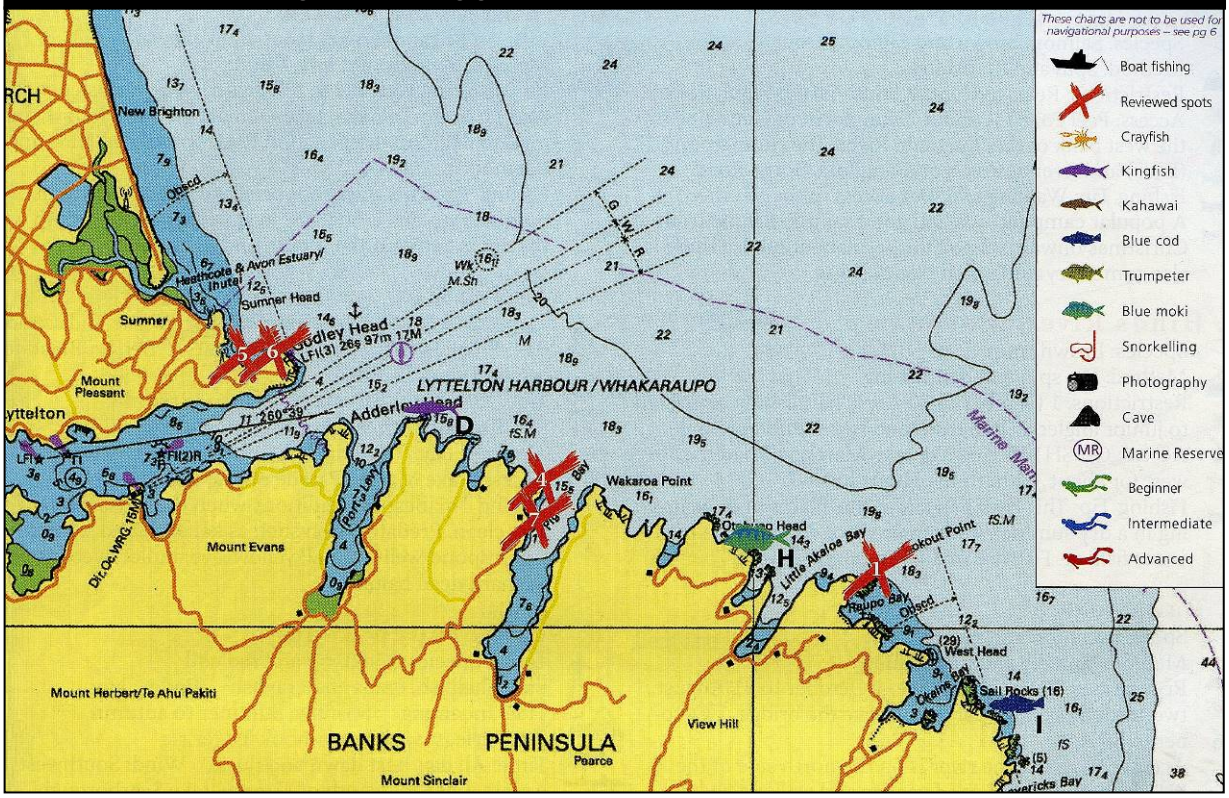
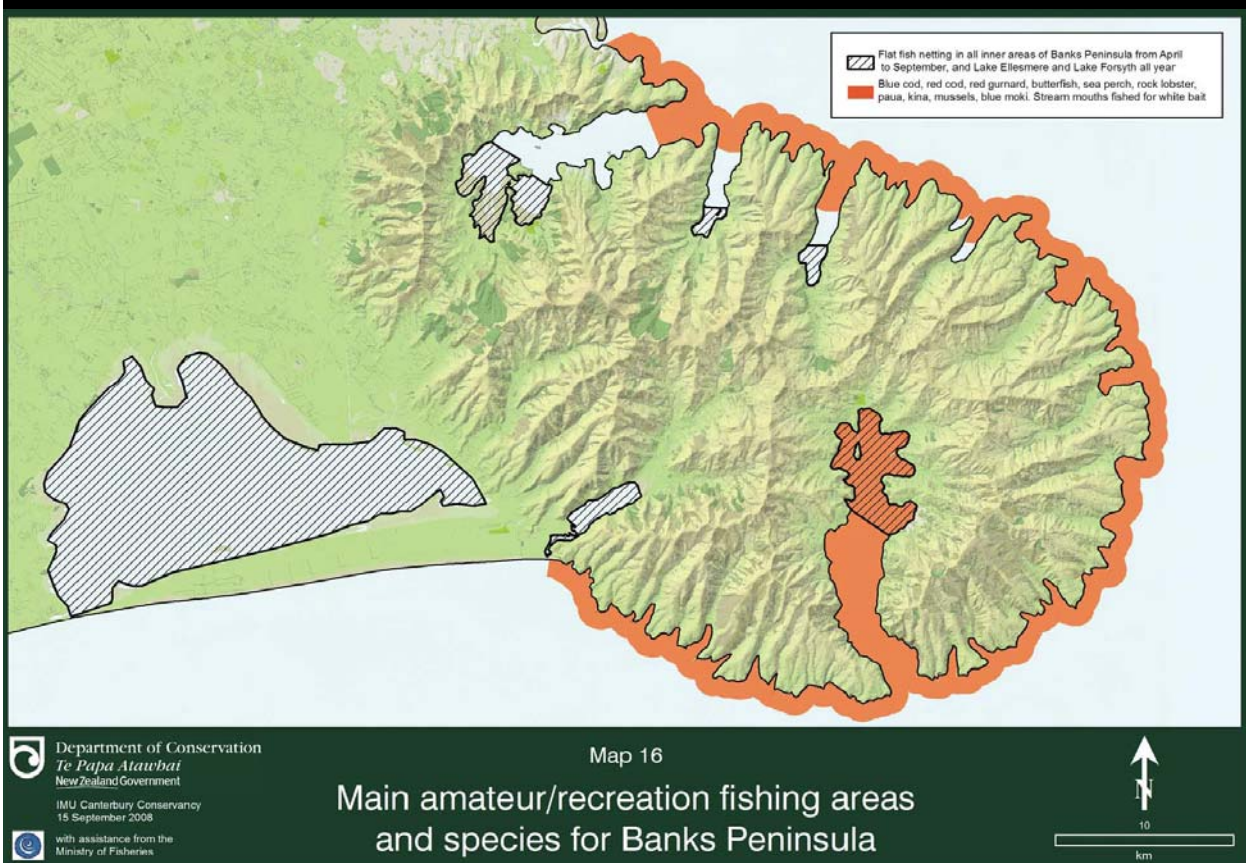


Figure 6: Main amateur/recreation fishing areas and species for Banks Peninsula. Benn (2009)



- An undated review (and likely quite old considering recommendations to access the wharves on a general basis) of how to catch small fish from wharves in fishingmag.co.nz notes:[7]

  On the, weekends there can be a big crowd of hopeful anglers trying their luck at Lyttelton. Most hurry down to the ends of the wharves. That's not where the fish are. In my experience better catches can be made from the end closest to shore. Here the little fish find abundant food and shelter amongst the rocks and wharf piles. You can even entice them out towards your baited hooks with a berley made from toasted bread crumbs: Looking over the side of the wharf, you can clearly see the little tiddlers dart out in search of a free meal.

  During days spent fishing at Lyttelton around October and November, the water was thick with whitebait. Unfortunately, I had no suitable net to scoop them up.

  Lyttelton Harbour offers something for everyone: spinning for salmon and kahawai; live-baiting for kingfish from the breakwater. And my old favorite, tiddler fishing.

- A more recent (but also undated) reference to shore-based fishing 'near Christchurch' on the same website describes only the purpose-built fishing wharf:[8]

  Lyttelton Harbour

  There is a new fishing platform behind the Oil Wharf. This has been purpose built for fishing. You do need to make a short cast though as the water is too shallow otherwise. Red cod in the evenings and at night. Heaps of mullet (use small hooks). Access to the port has been almost completely closed off to the public in recent years. But sometimes one of the wharves is opened up for the public to go fishing.

- Fishingmag is more enthusiastic about offshore fishing (undated reference):[9]

  Canterbury has seen a mini explosion of charter operators over the past decade - previously there had been none. Top boats and skippers are now working this sometimes wild and difficult coast taking keen fishos out on a unique angling experience. There has always been excellent fishing off Canterbury, it's just been hard to get at. After all thirty miles offshore in a 20 foot trailer boat is no place to be!

  The deep sea off Canterbury is teeming with big fish waiting to be caught on rod and reel. In fact it is only now that many are beginning to realize some of the possibilities for game fishing. Albacore tuna can be caught much further south than Kaikoura. Big mako sharks are regularly caught off Banks Peninsula. Many also believe that it's just a matter of time before a bluefin tuna is caught off Canterbury (they have been caught at Kaikoura), or possibly even a broadbill swordfish (sighted off Kaikoura).

  There is also very good bottom fishing off Canterbury for blue cod, perch, groper and trumpeter. The problem is that the best fishing is 27 nautical miles, or more, from Lyttelton. This is really outside the limit of small 20 foot trailer craft. Although boaties do go out to the "hole" it is quite dangerous because such boats provide little in the way of a safety margin should things go wrong

[7] http://www.fishingmag.co.nz/tiddler-fishing.htm
[8] http://www.fishingmag.co.nz/surfcasting-canterbury-spot.htm
[9] http://www.fishingmag.co.nz/deepsea-charter-fishing.htm

- Fishing forums are generally not complimentary about fishing options in the Harbour. For example (verbatim 2002 - 2006):[10]

  Hi there, does anyone know of good spots to fish off a boat in the Lyttelton Harbour area?

  Dave,
  Unfortunately you have picked one of the worst places to live for boat fishing... The seafloor is Sandy and shallow for the first 15 - 20 miles, then you start getting into the good fishing. However that is a decent trip for a small runabout. Motanau is good (Just on the chch side of the hurunui river). Or if you can drive to Goose Bay, just b4 kaikoura you will do well. Some folks catch a few cod in Akaroa, but I would rather spend the time driving to motanau myself. Tight Lines ps sometimes Kingfish are caught off black rock by taylors mistake. (jan - mar)

And:

  Hello
  I was wondering if anyone could name some good spots to fish in Lyttelton and what sort of fish I can expect to catch there, appropriate baits and lines etc? Have just started up fishing after a long break and would be grateful for any info.

  - Only place you can fish now is off the rocks by the boat ramp, everywhere else is blocked off, you can expect to catch dogfish, dogfish and more dogfish oh and rubbish red cod and rays. Not exactly a prime fishing spot for decent species to take home to eat.

  Hi
  Sorry forgot to mention that I will be fishing from a boat. Went out yesterday with my big brother and caught a dogfish and another unknown larger fish that broke the reel and got away. Yeah dogfish and mangy red cod do seem to be in full supply over there

  - If your boat is worthy enough try around the headlands particularly at the harbour entrance & beyond, been Kingfish hanging around there up to 20kg if your gears up to it. I always found launching at Scarborough easier & quicker than the trek up the harbour though.

And

  Has anyone got experience fishing lyttelton harbour. I'm wondering if it's worthwhile giving it a go. And has anyone had any success with flounder from a kayak? Berkley make some soft plastic sea worms. I think flounder may go for them.

  Lyttelton harbour offers crap fishin, too many trawlers @ motor boats to run you over, the best bet is the south coast of the peninsular in the right conds. or it may be worth chasin kingies off taylors after xmas.[11]

Reference is made to kingfish being available (between 2011 and 2013):[12]

  Has anyone here had experience catching kings around Banks Peninsula, Taylors, Sumner etc ? I have read plenty of reports of fish sighted or caught but haven't found much in this forum. I plan to drag some lures or drop some jigs from Sumner to the Lyttelton Heads this summer and would be interested to hear from

[10] http://www.asquickas.com/issues/issues.cgi?forum=2&thread=336
[11] http://www.fishing.net.nz/asp_forums/lyttelton_topic25388.html
[12] http://www.fishing.net.nz/forum/canterbury-kingfish_topic61451.html

> *anyone that has done this successfully. Maybe even beside the mussell farms mite work ?....*
>
> *I haven't seen any yet, last year it was late February? But they do appear around Taylors and Port Levy up by the mussel beds. Lost a reel that was destroyed in seconds by hooking one, didn't know there were Kingfish down here, and wasn't ready nor expecting them. From the ones I saw last year, only the very biggest make the trip or survive? I'm looking at some gear that hopefully I'll be able to hook and land one or more. But as I said, my snorkelling around Taylors I have seen none. Maybe they just aren't in close yet?....*
>
> *they'll be about by now [January], best to fish after a few easterly blows cos they push the blue water inshore, fish the weed rafts on the blue water line!*

Te Rūnanga o Ngāi Tahu applied in April 2014 to the Ministry for Primary Industries to create the Whakaraupō Mātaitai Reserve in the harbour east of a line from the southern end of Livingstone Bay in the north to Deep Gully Bay in the south (Jolly 2014). The existing Rāpaki Mātaitai Reserve (enclosing Rāpaki Bay from a line inshore from the headlands east and west of the Bay) applies bylaws which prohibit, for example, the taking of rays and skate, paua and seaweed (apart from *Undaria*), limits the daily take for pipi and cockles, and requires reporting of any fishing to the Rāpaki Marae Office (Ministry of Fisheries 2002).

Tonkin & Taylor (2016b) in their assessment of mahinga kai resources in and around the Harbour (as part of their aquaculture assessment) identified more than twenty marine species which may have some recreational harvesting values, including green-lipped and blue mussels, oysters and other bivalves, kina, several molluscs, octopus, a sea squirt, paua and several species of seaweed.

2.4 Swimming, surfing and diving

Environment Canterbury assesses the water quality for contact recreation of the main swimming sites in the Region. Within Lyttelton Harbour / Whakaraupō, nine sites are monitored for faecal contamination indicator bacteria and the risk of contamination (clockwise from Purau Bay):[13]

- Purau Bay
- Diamond Harbour Bay
- Church Bay
- Paradise Swimming Beach
- Paradise Beach
- Governors Bay
- Rapaki Bay
- Cass Bay
- Corsair Bay

Over the summer of 2015/16 these sites were rated 'good' (green) for swimming. Water clarity is not measured at these swimming sites.

Russell (1990) indicates swimming occurs at the boat-accessible bays inside Adderley Head and at Camp Bay.

Figure 7: ECan monitored swimming sites and recreational water quality April 2016

[13] http://maps.ecan.govt.nz/WaterQuality/

The *Wavetrack New Zealand Surfing Guide* (Morse & Brunskill 2004) identifies a number of surfing sites north of the harbour entrance, with the closest at Taylors Mistake, Sumner Beach and Bar and South Shore (Figure 8). To the east, the closest recommended surfing site is Raupo Bay. There are no surf breaks of national significance in Canterbury identified in the NZ Coastal Policy Statement (DOC 2010).

Figure 8: NZ Surfing Guide recommendations, Taylors Mistake to New Brighton (Morse & Brunskill 2004)

The Spot X *Diving NZ* guide (Enderby & Enderby 2007) identifies Boulder Bay (point 6 in Figure 5 on page 12) and Pigeon Bay as the closest dive sites to Lyttelton Harbour / Whakaraupō, noting that at the former the dive is, "not good with a swell and after rain which turns the water into cold tea", and at the latter, "the visibility can be poor especially after rain." Boulder Bay has "small crayfish" and "a few mussels on tops of the rocks plus kina."

2.5 Boating

The Banks Peninsula District Plan (October 2012, Ch28) describes Lyttelton Harbour / Whakaraupō:

> *Lyttelton Harbour is a focus for marine and port activities of regional significance. In addition to the substantial scope and scale of commercial shipping activities in the harbour, supported by the activities within the Lyttelton Port Zone, a range of recreational boating activities takes place on the harbour waters. Facilities to support these activities are presently provided in a limited fashion on the foreshore at several locations around the coast, including Magazine Bay, Charteris Bay, Purau and Governors Bay. These facilities include launching and retrieving facilities, storage facilities, moorings and servicing facilities.*

Boating clubs in the Harbour are:

- Naval Point Club Lyttelton (established by uniting the Banks Peninsula Cruising Club and the Canterbury Yacht and Motor Boat Club in 2001);
- Charteris Bay Yacht Club (absent from Figure 3);
- Te Waka Pounamu, waka ama based at Naval Point.

Other clubs not based in the Harbour, such as the Canterbury Outboard Boating Club and Canterbury Classic and Traditional Boats, holds events in the Harbour.[14] Harbour user groups are represented by such societies as the Purau Moorings Association. The NZ Sea Cadets maintain a club room at Cass Bay (TS Steadfast) and the Lyttelton Sea Scouts have a clubroom at Naval Point.

Boat moorings are available in the: Magazine Bay Marina, Lyttelton Inner Harbour pile moorings, Cass Bay moorings, Corsair Bay Moorings, Purau moorings, Diamond Harbour pile moorings, and Charteris and Church Bay moorings.

Boat launching facilities are available at Charteris Bay, Cass Bay, Purau, Lyttelton Slipway and near the inner harbour near Stark's Engineering.

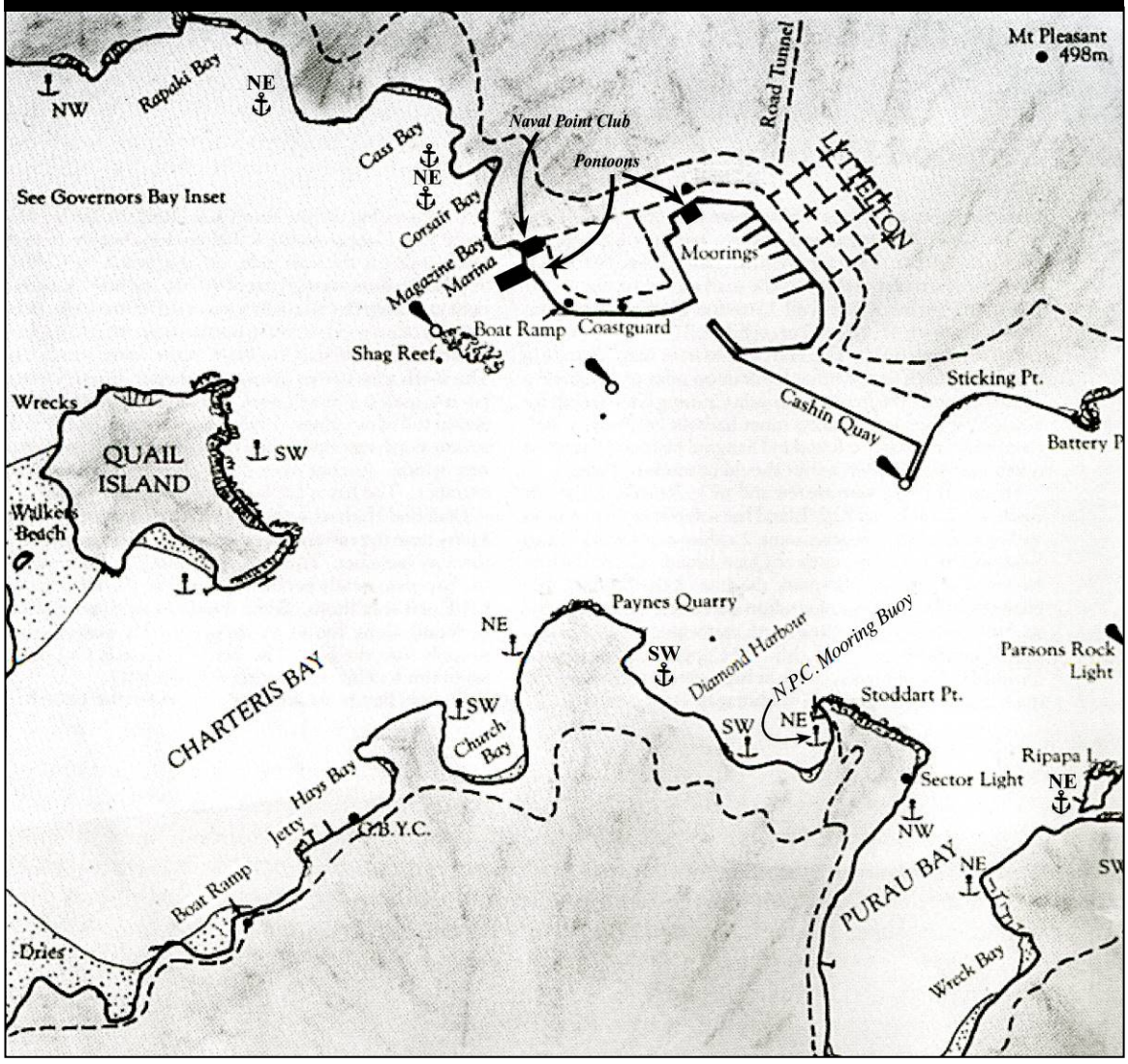
The *Cruising Guide South Island East Coast* (Paterson 2010) identifies Diamond Harbour as the "most popular anchorage" in Lyttelton Harbour / Whakaraupō, and notes:

> *Hazards to navigation as few and are well marked…. Conical white towers at either end also mark the line of the dredged ship channel up the harbour. Lyttelton Harbour is exposed to the sea built up by the prevailing north east wind and anchorages should be chosen to avoid this. The upper reaches beyond Quail Island are only navigable at high water and that part of the harbour has no practical anchorages.*

Anchorages are indicated by Paterson (2010) in the central and outer harbour area are on its southern side (Figure 9 and Figure 10), and in the dredging spoil area within the harbour at Breeze Bay and Gollans Bay (Figure 10).

[14] See for example, http://www.cobc.co.nz/calendar-2013/

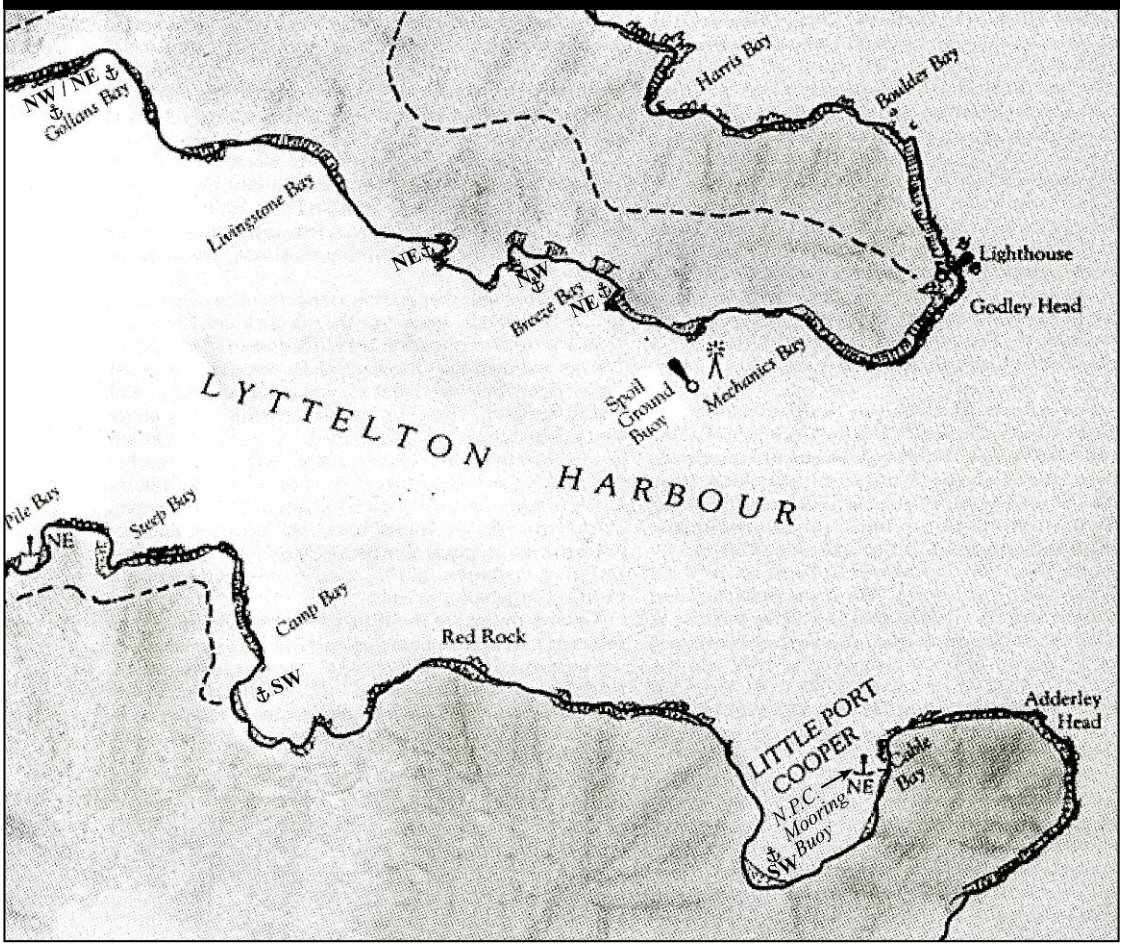
Figure 9: Central harbour anchorages identified in Paterson (2010)



Windsurfing, small dinghy sailing, water skiing, sea kayaking, paddling boarding and other small boat activity are commonly observed, predominantly in the central Harbour area and around Quail Island. Small dinghy sail racing is generally held to the south of Shag Reef, with race-control based on a committee boat.

Wednesday and weekend keeler and trailer-sailer racing is mostly managed from the shore-based start box on CCC land at the southern end of Godley Quay (location marked as 'Coastguard' in Figure 14). Wednesday-night keel-boat racing starts in October and generally runs through the daylight-savings period, with race starts at 6.30 pm, with boats on the water for up to an hour prior. Saturday races start in late September and are generally held from 10am to 1pm and/or 1pm to 4pm. Winter Sunday races are held through May and June. The shore-based starting box provides engagement for older club members who might no longer race, as well as spectator opportunities.

Figure 10: Outer harbour anchorages identified in Paterson (2010)



Jolly (2014) discusses the activities of waka ama (outrigger canoes), waka taua (traditional canoes), and waka unua (sailing canoes) on the Harbour, with waka ama described as being used on the harbour every day by both individuals and groups, largely involved in training for competition, as well as for general recreation. Jolly (2014) notes that waka taua and waka unua, while currently only occasional uses of the harbour, may become more frequent sights with the ongoing revitalisation of waka culture around the Pacific, in New Zealand and in Te Waipounamu (the South Island). Waka launching and storage is largely focused at Naval Point.

A count of vessels in Lyttelton Harbour / Whakaraupō relying on satellite images on Google Maps between 2003 and 2014 (via Google Earth) shows approximately 250 launches and keelers at anchor, on swing moorings, pile moorings or at the Naval Point marina, and that this count has remained reasonably consistent over the years.[15] Another 100 vessels are moored in Akaroa Harbour. If ownership was proportional to population there would be the potential for over 2,500 large vessels to be owned in Canterbury (see MNZ data in section 2.1). Although there is an unknown number of trailerable craft in Canterbury (and probably an over-representation of jet boats) this apparent relatively low level of large-vessel activity is not surprising considering the low level of service for on-water boat storage in Canterbury (including many exposed moorings and no vessel insurance available for boats on the Naval Point marina).

[15] 2013 count: Inner harbour piles: 74. Cass and Corsair Bays moorings: 42. Naval Point marina: 32. Church Bay and Diamond Harbour: 23. Purau Bay: 75.

2.6 Tourism and commercial marine recreation

The Ministry of Business, Innovation and Employment has recently upgraded is methodology for its Domestic Visitor Survey and International Visitor Surveys, and specific activity participation data for the two markets are no longer provided at the regional level. At the national level, water-based activities are some of the most popular. Unfortunately, the relevant data are not subdivided by marine and freshwater settings, so, while 4% of domestic tourism trips included swimming in 2012 (that is, 1.68 million domestic 'trips' included swimming as an activity), this includes swimming in pools, rivers, lakes and the sea. Fishing, with 3% participation for domestic tourists (1.41 million 'trips') similarly includes trout and salmon as well as purely marine species. Boating (marine and fresh) was carried out on 517,000 trips (1.1% of all trips) and dolphin watching was enjoyed on 41,104 'trips' (0.09%). Dining (31%), visiting friends and relatives (21%) and shopping (21%) are the prime domestic tourism activities.

International tourists undertake more activities than domestics, with, for example, 92% of international visitors dining and 80% shopping in 2013. Boating (marine and fresh) was undertaken by 23%, swimming by 12%, bird watching by 7%, and fishing and dolphin watching by 5%.

In Lyttelton Harbour / Whakaraupō, several providers of tourism and commercial recreation activities can be located online, all of whom are operating at the time of preparing this report:

- Black Cat Cruises – operates the Diamond Harbour Ferry as well offering trips to Quail Island and private charters (including to Ripapa Island) and dinner cruises (http://www.blackcat.co.nz/)
- Fox II – evening sailing charters on a classic sailing trawler in Lyttelton Harbour / Whakaraupō, October to December (http://www.charterguide.co.nz/hts/604.htm)
- Jack Tar Sailing Company – chartered sightseeing and sail training in a classic yacht, with the possibility of dolphin viewing (http://jacktarsailing.co.nz/)
- Learn 2 Sail – sailing tuition on Lyttelton Harbour / Whakaraupō (http://www.learn2sail.co.nz/)
- Lyttelton Kayaks – sea kayak hire (and manufacturing) launching from Cass Bay (http://www.oneoutdoors.com/)
- Lyttelton Tug – public Sunday afternoon cruises from December to April or May and charters from September to June (approximately) by the Tug Lyttelton Preservation Society (http://www.nzmaritime.co.nz/tug.htm)
- Volo Jetski Adventures – jet ski harbour tours and fly boarding (water 'jet pack'), including dolphin-spotting (http://www.volojetskis.co.nz/)

Black Cat Cruises operated wildlife and scenic cruises in Lyttelton Harbour / Whakaraupō prior to the earthquakes (in addition to the activities listed above), but has since focused this activity in Akaroa and is unlikely to restart it in Lyttelton.[16]

Cruise ships were regular visitors to Lyttelton prior to the 2011 earthquakes, with 50 ships in the 2009/10 season (generally October to early April) carrying approximately 100,000 passengers, mostly from the UK, Australia and the US. This traffic is currently accessing Canterbury via Akaroa.

[16] Paul Bingham, Black Cat Cruises, pers comm.

The 2012 edition of the New Zealand Lonely Planet recommends several walks around the Harbour and Black Cat cruises to Diamond Harbour and Quail Island, and otherwise focuses on local eating and drinking options.

An online search of fishing charter operators in Canterbury indicates Kaikoura and Motunau are the main locations in the region for this activity.

2.7 Terrestrial recreation

The Walking Access Commission's online Walking Access Mapping System (WAMS) describes the public access opportunities around Lyttelton Harbour / Whakaraupō (Figure 11).[17] This includes Department of Conservation and Christchurch City reserves and walkways.

Unformed legal road also bounds almost all of the harbour edge (not shown in Figure 11).

Ripapa Island is an important heritage site, including the existing Fort Jervois, but also the site of a Ngāi Tahu pa, a quarantine station and a prison. Access is by boat only (Black Cat offers charters) but the island is currently closed due to earthquake damage.

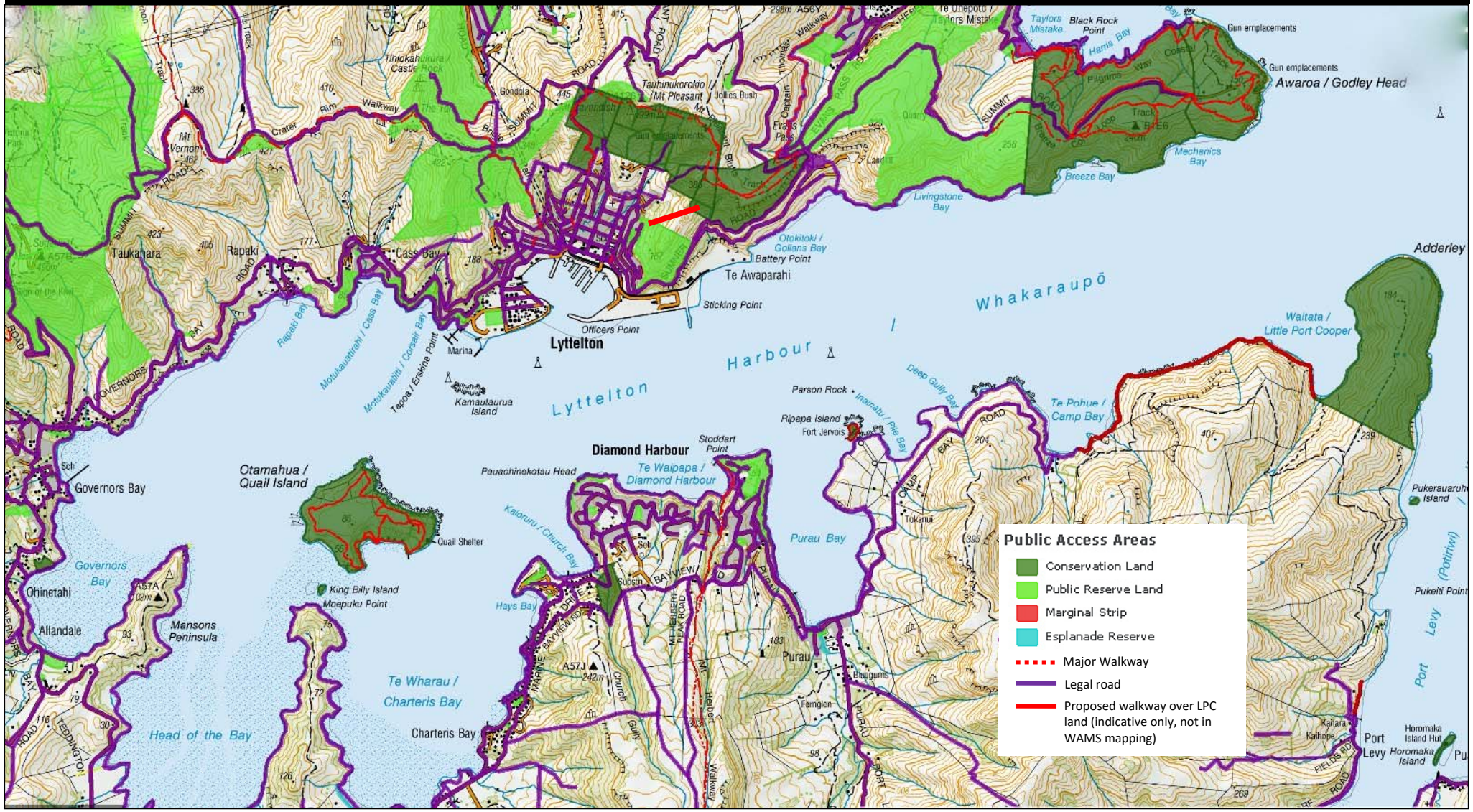
Notable recreation routes in and around the harbour include:

- The 'Long Bays' road cycle route which, within the harbour, runs from Gebbies Pass to Evans Pass via Governors Bay and Lyttelton (using Norwich Quay or London Street). This route is currently unavailable due to the closure of Evans Pass.
- The proposed Head to Head walkway from Adderley Head to Godley Head. The route for this through Lyttelton is not yet defined (Lyttelton Master Plan 2012, p66).
- The Crater Rim Walkway and other Port Hills tracks, including in particular the Bridal Path route from Lyttelton to Heathcote Valley, tracks at Living Springs, Diamond Harbour (although many of these are in poor condition), Governors Bay, Orton Bradley Park, the Mount Herbert Walkway, and the proposed 'Double Fence-line' or 'Spine of the Lizard' track, using existing tracks, and existing and new facilities, from Gebbies Pass to Hilltop.

The Lyttelton Port Company has signed a memorandum of understanding with the CCC to enable public access through its privately held land between Urumau Recreation Reserve and Tauhinu-Korokio Scenic Reserve. This creates a walking link between the end of Foster Terrace in east Lyttelton and the Crater Rim Walkway (shown as an addition in Figure 11 and is not within the WAMS mapping system).

[17] http://wams.org.nz/

Figure 11: Public access around Lyttelton Harbour – Source: WAMS Aug 2016 – based on 1:50,000 topo map



3 Information from LPC consultation

Chapter 6 of the AEE details the public consultation efforts of LPC from 2008 to 2016. Those consulted included:

- Black Cat Cruises
- Tug Lyttelton
- Surfrider Environmental Advocacy
- Lyttelton Environment Group
- Lyttelton Harbour Issues Group
- Department of Conservation
- Lyttelton Community Association
- Maritime NZ
- Naval Point Yacht Club
- Canterbury Sportfishing Club
- Te Hapū o Ngāti Wheke
- Te Rūnanga o Koukourārata
- Te Rūnanga o Ngāi Tahu

Issues identified through consultation of relevance to recreation include:

- Sedimentation effects on shellfish in Port Levy / Koukourārata
- Sediment flows generally, including those into Sumner and the upper harbour
- Changes in wave and current action in Lyttelton Harbour / Whakaraupō
- Wave effects from the boat wash of larger vessels
- Ecological effects of the offshore and in-harbour spoil disposal sites
- Effects of additional vessel traffic

These and other issues of interest to recreation are considered in the following section. Biosecurity hazards where also identified but are assessed in the proposal AEE and form part of standard international best practice.

4 CDP effects of interest to recreation

Considering the recreational uses of Lyttelton Harbour / Whakaraupō, the following potential effects of the CDP are of interest:

- Changes to water clarity affecting swimming and diving opportunities, and visual amenity, and increased sediment mobility resulting in increased rates of shallowing of the upper Harbour;
- Dredging and sediment effects on marine biota changing the location, quality and scale of the angling and resource in the Harbour and around the offshore spoil disposal sites, as well as inshore shellfish harvesting;
- Occupation of the marine environment by dredging vessels and increased activity of large commercial vessels in the Harbour, including wake effects on boating and shore-based activities;
- Changes to wave and current activity resulting from depth changes in the Harbour and north and south of the Heads affecting boating, beach activities and surfing; and
- Any effects on marine mammals and birds viewed by recreational visitors to the Harbour.

Each of these is addressed below.

4.1 Water clarity and sediment

The ANZECC (2000) water quality guidelines for visual clarity and colour state:

> *To protect the aesthetic quality of a waterbody:*
>
> *• the natural visual clarity should not be reduced by more than 20%;*
>
> *• the natural hue of the water should not be changed by more than 10 points on the Munsell Scale;*
>
> *• the natural reflectance of the water should not be changed by more than 50%.*
>
> *To protect the visual clarity of waters used for swimming, the horizontal sighting of a 200 mm diameter black disc (Secchi disc) should exceed 1.6 m.*

These are based on (ANZECC, 2000):

> *Davies-Colley (1991) recommended that a better guideline for the visual clarity relevant to swimmer safety in wadeable areas would be to require that the black disc visibility should be not less than 1.6 m, which is equivalent to the bottom of the waterbody being visible at an adult chest height of around 1.2 m. For diving areas, the water clarity would need to be considerably greater than this.*

The World Health Organization *Guidelines for safe recreational water environments* (WHO 2003) note:

> *Some regulatory authorities have recommended absolute values for transparency/colour and turbidity in recreational waters. This approach can be difficult to apply at local level because many waters may have naturally high levels of turbidity and colour. It is therefore more common that changes from the normal situation are used to indicate potential water pollution.*

ECan does not report on water clarity at its monitored marine swimming sites. Busy summer swimming settings like Corsair Bay commonly have high turbidity levels.

OCEL (2016) indicate that Lyttelton Harbour / Whakaraupō has relatively high turbidity which only settles after sustained periods of calm and dry weather, and that existing dredging activities have 'no significant' effect on levels around Lyttelton Harbour / Whakaraupō. Pegasus Bay also has high natural turbidity levels. OCEL measurements carried out during trial disposal of spoil in the offshore sites found that the additional turbidity created was 'indistinguishable' from the natural levels at the time.

Dredge plume modelling carried out by MetOcean Solutions Ltd (2016a) indicate that increases in turbidity within the harbour as a result of extraction and dredge overflow are largely contained within the dredge channel footprint, which aligns with tidal flow directions. MetOcean Solutions Ltd (2016b, 2016c) show no potential for sediment from the offshore disposal site to reach inshore recreation settings. MetOcean Solutions Ltd (2016c) considers sediment effects from the maintenance spoil disposal grounds, and states (p50):

> *Results suggest that limited suspended sediment in the near-bed region may reach towards the coastline at Godley Head, southeast of Port Levy / Koukourārata, however in reality these levels are likely to be well below ambient concentrations and sediment is not expected to settle at or near the shoreline due to the energetic nature of the coastal zone.*

These assessments indicate little potential for adverse effects from sediment on visual and recreation amenity, with little or no departure from that currently experienced by recreational users of the coastal marine environment.

4.2 Effects on biota

Sneddon (2016) found no marine features of special scientific or conservation interest in field surveys of the areas proposed to be dredged, but located populations of paua, lobster (crayfish) and green lipped mussels in subtidal reef zones in and around the Harbour, as well as several recreational fin fish species such as yellow eyed mullet, red cod, flounder and spotted stargazer. The marine ecology analysis found very limited potential for adverse effects on these species due, largely, to the existing high levels of turbidity in the affected areas and the natural resilience of the marine species; and the temporary and episodic nature, and scale, of the dredging activities.

Sneddon (2016) also indicates that while there will be temporary displacement effects on biota within the offshore dumping ground, the sea-bed in the area is characterised by non-habitat forming species which naturally recover rapidly from disturbance and which occupy substrate very similar to that which will be deposited. No effects were identified for fin fish, which tend to occupy territory much further from the coast.

No effects were identified for shellfish or other biota in Port Levy / Koukourārata and other inlets on the northern coast of Banks Peninsula due to their distance from the spoil areas and the direction of naturally occurring currents, and the natural adaptation of the inshore and offshore ecological communities to relatively high normal levels of turbidity.

The offshore dumping ground is between 6 km and 9 km offshore. Offshore recreational deep-water fishing areas are reported to be almost 50 km offshore (section 2.3).

Tonkin & Taylor (2016b) considered the potential effects of dredging and sedimentation on mahinga kai for more than 20 species, including shellfish, seaweed, crayfish, molluscs, sea tulip and octopus. They noted very healthy assemblages of key mahinga kai species very near the existing maintenance dredge disposal site on the northern side of the Harbour, including some of the highest and higher local densities of mussels and paua. Considering the high normal levels of sedimentation and turbidity in the coastal environment, the species' tolerance of this, and the low potential for increased inshore sedimentation as a result of the

Project, Tonkin & Taylor indicated little potential for adverse effects. No biota of recreational interest were located in the proposed and existing dredge channels.

4.3 Activity of commercial vessels

The first stage of the CDP is expected to take between nine and fourteen months, with maintenance dredging carried out in the same manner as currently, but for longer periods to cover the additional dredged channel depending on the size of the dredge to be used. This will result in the presence of a larger-than-normal dredge vessel in the harbour during the CDP, and the presence of the maintenance dredges now used for longer periods. The vessels will generate wakes when moving between spoil disposal grounds and dredging sites.

This will result in the need for more frequent avoidance behaviour by water craft, which will affect sailing craft the most as they tack in or out of the Harbour.

Such activity is a normal part of boating where a commercial port is located, and does not represent the creation of a new or unexpected hazard. It may be considered a minor adverse effect by boaters who regularly use the outer Harbour.

LPC also indicates that catering for larger vessels will mean less vessel traffic on a per container basis in the short term. Vessel traffic will, however, increase over time, and it is predicted that in 30 years there would be approximately four times the number of vessels visiting the port.

Wake effects of large moving vessels were identified as a concern through consultation. However, LPC indicates that all large vessels entering the Port are very slow-moving and generate little wake.

4.4 Changes to waves and currents

Goring (2016) indicates that the net effect of dredging on waves in the Harbour will be an increase in the size of swell waves at the entrance – particularly to the south – as these waves are refracted away from the shipping channel; but that swell wave height will be reduced in the mid- and upper Harbour. ‘Slight’ effects on currents are possible near the dredged channel. Tide strength and wave energy will decrease in the Diamond Harbour and Purau Bay anchorages.

The reduction in wave energy may result in a net benefit to recreation, as the most intensely used areas for small boat activity are within the mid-Harbour, and there are reductions in tidal and wave energy in the anchorages at Diamond Harbour and Purau Bay. Conversely, there may be some reduction in amenity in the outer Harbour bays, although the scale of change is likely be small and intermittent and difficult to discern. At the times that swell waves are acting on beaches in the outer Harbour (when changes in wave height might occur), near-shore recreational activity is likely to be naturally unattractive.

MetOcean Solutions Ltd (2016d) modelled changes to coastal wave patterns resulting from shallower bathymetry at the capital and maintenance disposal grounds. This illustrates some very minor changes to swell wave energy reaching the coast between Pigeon Point and New Brighton, with increases or decreases of less than five centimetres of wave height (or no change) depending on wave direction. These are likely to be undetectable by, for example, surfers, and reducing in scale as the capital disposal grounds deepen due to gradual dispersal of dredge material.

Tonkin & Taylor (2016a) reviews these data (Goring (2016) and MetOcean Solutions Ltd (2016d)) and concludes that there is no potential for changes to wave patterns to alter shoreline processes due to their small scale and, in the case of beaches west of Adderley Head, also their robust and stony nature.

4.5 Effects on marine mammals and birds

Observing marine mammals and birds is commonly associated with boating experiences in the outer harbour and offshore.

Effects of the Project on marine mammals have been assessed by the Cawthron Institute (Clement 2016). Hector's dolphins are considered to be accustomed to dredging activity and are assessed as unlikely to be affected, but potentially attracted to dredging areas due to curiosity and the presence of disturbed prey species. Effects on habitat disturbance and food availability are assessed as small and temporary. While Clement (2016) considers effects on other marine mammals, such as southern right whales, these are very rarely sighted and are unlikely to have recreation or tourism value (that is, the chance of sighting one will not be motivation to head offshore in recreation craft).

Boffa Miskell (2016) reviewed potential effects on seabirds as a result of their direct disturbance, the potential for bird strike, changes to food supply, foraging ability and the potential effects of pollution. Seventeen species were identified as of potential interest, and the presence of these – such as terns, shags and little blue penguin – will contribute to the quality of coastal recreation and tourism experiences. For the majority of species the level of potential effect was determined to be 'Low or Very Low' due to the mobile nature of the species, their relatively large foraging areas and the restricted extent and term of any effects. A potential 'Moderate' effect was identified for little blue penguins, but no mitigation is proposed due to the temporary nature and scale of the effects (the basis of the assessment is very similar for other bird species, but the penguin has a different conservation status).

5 Conclusion

Lyttelton Harbour / Whakaraupō is a regionally important marine recreation setting. While the fishing resource is regarded as quite average, it does provide an inshore recreation opportunity. Small boat sailing is popular, especially in the inner Harbour. There are limited commercial recreation and tourism services, largely confined to several charter vessels, including the Lyttelton Tug and the regular service of the Black Cat ferry.

The potential adverse effects of the proposal are quite limited and confined. The presence of the CDP dredging vessel will be an additional consideration for boats using the outer harbour, as will the longer attendance of the maintenance dredge. However, this effect sits within the existing experience of commonly encountering commercial vessel traffic, which will inevitably increase. This change in experience will also relate to terrestrial recreation in terms of visual amenity effects.

Wave energy levels in the inner Harbour are predicted to reduce, which is likely to be considered a benefit to boating activities there, including at the Diamond Harbour and Purau Bay anchorages. Some very minor adverse effect may result from increased wave action at the outer bays inside Adderley Head, although recreational use of these areas is likely to be naturally very low when swell waves are in action. There is no anticipated potential for effects on shore-line processes.

Changes in sediment and turbidity levels are confined and temporary and do not affect any recreation settings or resources. There are no anticipated effects on marine mammals or birds of relevance to recreation.

Overall, the net effect on recreation and tourism of the dredging proposal is likely to be slight and similar to the status quo.

6 References

Airey, M. 2012. *Spot X Boat Fishing New Zealand.* Spot X Publications, Auckland

Allen, W. Elmetri, I. Clarke, S. Gibbons. J. Clark, K., Sinner, J., Jiang, W. and Taylor, M. 2009. *Mapping the Values of New Zealand's Coastal Waters. 3. Social Values*. Biosecurity New Zealand

ANZECC 1992. *Australian and New Zealand Guidelines for fresh and marine water quality*. Australia and New Zealand Environment and Conservation Council

ANZECC & ARMCANZ, 2000. *Australian and New Zealand Guidelines for fresh and marine water quality*. Australia and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand

Benn, J.L. 2009. *Canterbury Marine Resource. A tool for marine planning, conservation and education.* Department of Conservation, Wellington

Boffa Miskell Limited, 2016. *Lyttelton Port Company Channel Deepening Project: Marine Avifauna Assessment*. Report prepared by Boffa Miskell Limited for Lyttelton Port Company Limited.

Clement D. 2016. *Assessment of Potential Effects on Marine Mammals of Proposed Capital Dredging of Approach Channel to Lyttelton Port of Christchurch and Offshore Disposal of Spoil*. Prepared for Lyttelton Port of Christchurch. Cawthron Report No.2869

Department of Conservation, 2014. Canterbury Conservation Management Strategy 2015-2025 revised draft. DOC, Wellington

Department of Conservation, 2010. *New Zealand Coastal Policy Statement 2010*. DOC, Wellington

Department of Conservation, 2000. *Canterbury Conservation Management Strategy*. DOC, Christchurch

Draper, M. 2012. *Sport X Surfcasting New Zealand.* Spot X Publications, Auckland

Draper, M. Enderby, T. Enderby J. (eds) 2008. *Sport X Fishing New Zealand.* Spot X Publications, Auckland

Enderby, T. Enderby J. 2007. *Sport X Diving New Zealand.* Spot X Publications, Auckland

Greenaway, R. 2014a. *Christchurch City Council Survey of Use of Marine Structures 2013 – 2014*. Client report for Christchurch City Council

Kearney, R.E. 2002. *Review of harvest estimates from recent New Zealand national marine recreational fishing surveys*. Applied Ecology Research Group University of Canberra

Hegley n. 2013. *Lyttelton Port of Christchurch Deepening of Port Access Assessment of Noise Effects*. Prepared for Lyttelton Port of Christchuch by Hegley Acoustic Consultants Report No 8526

Jolly, D. 2014. *Cultural Impact Assessment: an assessment of the effects of the Port Lyttelton Plan and Lyttelton Port Recovery Plan on Ngāi Tahu values and interests.* Wītaskēwin client report for LPC

Marine Industry of New Zealand, 2007. *Marine Industry of New Zealand Annual Report for period to 31 December 2007*. MIA, Auckland

Maritime New Zealand, 2007. *Boating Safety Strategy - 2007 Review of the New Zealand Pleasure Boat Safety Strategy*. MNZ, Auckland

MetOcean Solutions Ltd, 2016a. *Lyttelton Port Company Channel Deepening Project – Simulations of Dredge Plumes from Dredging Activities in the Channel*. Client report prepared for Prepared for Lyttelton Port Company Limited.

MetOcean Solutions Ltd, 2016b. *Lyttelton Port Company Channel Deepening Project – Simulations of suspended sediment plumes generated from the deposition of spoil at the offshore capital disposal site.* Client report prepared for Prepared for Lyttelton Port Company Limited.

MetOcean Solutions Ltd, 2016c. *Lyttelton Port Company Channel Deepening Project – Simulations of suspended sediment plumes generated from the deposition of spoil at proposed maintenance disposal grounds*. Client report prepared for Prepared for Lyttelton Port Company Limited.

MetOcean Solutions Ltd, 2016d. *Lyttelton Port Company Channel Deepening Project – Numerical modelling of sediment dynamics for a proposed offshore capital disposal ground.* Client report prepared for Prepared for Lyttelton Port Company Limited.

MetOcean Solutions Ltd, 2016e. *Lyttelton Port Company Channel Deepening Project – Numerical modelling of sediment dynamics at proposed offshore maintenance disposal ground.* Client report prepared for Prepared for Lyttelton Port Company Limited.

Ministry of Fisheries, 2002. *Rāpaki Mātaitai Reserve.* Advisory brochure. MoF (now MPI), Wellington

Morse, P.B Brunskill, P. 2004. *Wavetrack New Zealand Surfing Guide*. Greenroom Surf Media, NZ

Mulgor Consultants Ltd, 2016. *Effects of Development Stages 2 and 3 on Waves and Tidal Currents in Lyttelton Harbour.* Mulgor Consulting Ltd Report No 2016/2

Reilly, J.L. 2002, *1999/2000 National marine recreational fishing survey: report on fishing prevalence measurement*. Draft report from Statistical Insights Ltd. Cited in Kearney, R.E. 2002. *Review of harvest estimates from recent New Zealand national marine recreational fishing surveys*. Applied Ecology Research Group University of Canberra

Russell, P. 1990. *1990 Coastal Resource Inventory (First Order Survey) for Canterbury*. Department of Conservation Canterbury Conservancy

Sneddon R. 2016. *Assessment of Impacts to Benthic Ecology and Marine Ecological Resources from Proposed Capital Dredging and Spoil Disposal Offshore from Lyttelton Harbour. Prepared for Lyttelton Port Company*. Cawthron Report No.2860

SPARC, 2009a. *Sport, Recreation and Physical Activity Participation Among New Zealand Adults Key Results of the 2007/08 Active New Zealand Survey*. Sport NZ, Wellington

SPARC, 2009b. *Sport and Recreation Profile: Fishing Findings from the 2007/2008 Active New Zealand Survey*. Sport NZ, Wellington

SPARC. 2009c. *Sport, Recreation and Physical Activity Profile: Canterbury West Coast Region 2007/08*. Sport NZ, Wellington

SPARC, 2009d. *Sport and Recreation Participation Levels Findings from the 2007/2008 Active New Zealand Survey*. Sport NZ, Wellington

Tonkin & Taylor, 2016a. *LPC Channel Deepening Project Review and summary of coastal process effects*. Client report prepared for LPC

Tonkin & Taylor, 2016b. *Assessment of Ecological Effects - Marine Farms.* Client report prepared for LPC.

World Health Organization. 2003. *Guidelines for safe recreational water environments. Volume 1, Coastal and fresh waters*. WHO, Geneva