Data in Brief 48 (2023) 109095

Contents lists available at ScienceDirect

Data in Brief

journal homepage: www.elsevier.com/locate/dib

Data Article

Fishery independent survey datasets of abalone populations on subtidal coastal reefs in southeastern Australia

Harry Gorfine[a,b,*], Justin Bell[a], Michael Cleland[c], Khageswor Giri[d]

[a] *Victorian Fisheries Authority, Queenscliff, Australia*
[b] *School of Biosciences, University of Melbourne, Australia*
[c] *RightIntoIT, Tinbeerwah, Australia*
[d] *Bundoora AgriBio Centre, Australia*

A R T I C L E I N F O

Article history:
Received 23 December 2022
Revised 20 March 2023
Accepted 21 March 2023
Available online 29 March 2023

Dataset link: Abalone-FIS (Original data)

Keywords:
Invertebrate abundance
Dive surveys
Data standardization
Shell size
Data sharing
Victorian coast

A B S T R A C T

Assessing the status or exploited marine fish populations often relies on fishery dependent catch and effort data reported by licensed commercial fishers in compliance with regulations and by recreational anglers voluntarily. This invariably leads to bias towards the fraction of a fish population or community that can be legally fished i.e., the stock as defined by legal minimum lengths and spatial boundaries. Data are restricted to populations which continue to be exploited at the expense of obtaining data on previously exploited and unexploited populations [1,2], so if a fishery is contracting spatially over time, then successively less of the overall fish community is monitored with bias towards where biomass is highest or most accessible [3]. A viable alternative is to conduct population monitoring surveys independently of a fishery to obtain information that is more broadly representative of the abundance, composition and size structure of fish communities and their supporting habitats [4–6]. Whereas catch and effort data often must be de-identified and aggregated to protect the confidentiality of fishers' commercial and personal interests, this constraint does not exist for independently acquired monitoring data, collected at public expense and hence publicly

* Corresponding author at: Victorian Fisheries Authority, Queenscliff Centre, 2A Bellarine Hwy, PO Box 114 Queenscliff, Victoria, Australia.

E-mail address: hgorfine@unimelb.edu.au (H. Gorfine).

https://doi.org/10.1016/j.dib.2023.109095

available at high levels of spatial and temporal resolution. Time series underpins the utility of fishery independent survey (FIS) datasets in terms of the life histories of exploited fish species and the time frames of their responses to various combinations of fishing mortality and environmental fluctuations and trends [7].

One-off surveys can establish a baseline and spatial distribution pattern, but regular surveys conducted consistently over time are necessary to detect trends from which population status can be inferred. We present several unique datasets focused on the commercially valuable blacklip abalone (*Haliotis rubra*), spanning three decades of annually collected data from up to 204 locations on subtidal rocky reefs along a coastline of almost 2500 km, the State of Victoria, Australia. It is rare for data to be collected consistently at this intensity over such a long period of monitoring [2], especially with surveys conducted by small teams of highly skilled research divers, some of whom up until recently had participated in every year.

The data comprises ~28,000 records from ~4500 site surveys conducted during 1992 to 2021 [2]. Although the fixed site design remained unchanged, the number of sites surveyed varied over time, mostly increasing in number periodically, and the survey method was refined on several occasions. We defined three different variants in the survey method due to technological advancement for both enumerating abalone abundance and measuring shell size structure [7]. The relative abundance counts were standardized using a Bayesian generalized linear mixed model (GLMM) to test for interannual trends whilst allowing for inherent differences among sites, research divers, and their interactions [8].

Specifications Table

Subject	Ecology
Specific subject area	Fisheries ecology Studies of exploited organisms in marine coastal reef systems
Type of data	Table
How data were acquired	Abalone, periwinkle and urchin abundance, abalone shell sizes, and habitat cover abundance were surveyed by research divers engaged by the Victorian Fisheries Authority and its predecessors during 1992–2021.
Data format	Raw, cleansed, summarized formats.
Description of data collection	~28,000 records from ~4500 site surveys at up to 204 locations along the Victorian coast during 1992–2021 (Figure 1 and Figure 2). Data include legal-sized (Figure 3) & sublegal-sized (Figure 4) abalone, periwinkle and urchin counts, abalone shell sizes (Figure 5 and Figure 6), habitat cover abundance and substrate. Data were recorded on datasheets (Figure 7 and Figure 8) then transcribed into a relational SQL database for later extraction and summary (Table 1).

(*continued on next page*)

Data source location	Institution: Victorian Fisheries Authority City: Queenscliff State: Victoria Country: Australia Latitude and longitude for collected samples/data: 37.51°S 149.97°E — 38.06°S 140.96°E https://goo.gl/maps/Aogpti1owWG3RdTq6 https://goo.gl/maps/h4MAPye3R4scn5mk7\ Mainland coastline 1868 km; island coastline 644 km https://www.ga.gov.au/scientific-topics/national-location-information/dimensions/border-lengths#heading-1
Data accessibility	Repository name: GitHub Direct URL to data https://github.com/Ekologas/Abalone-FIS doi:10.52081/zenodo.7053408 [2]
Related research article	Holland, O., Young, M.A., Sherman, C.D.H., Tan, M.H., Gorfine, H., Matthews, T. and Miller, A.D. 2021. Ocean warming threatens key trophic interactions supporting a commercial fishery in a climate change hotspot. *Global Change Biology* 27: 6498–6511. doi:10.1111/gcb.15889 [1]

Value of the Data

- Marine coastal ecosystems are highly vulnerable to global warming, pollution, intensive fishing, and other human impacts. Detailed annual monitoring data collected over three decades, as presented here, can be used to establish baselines of ecosystem status and to assess human impacts in terms of the extent of change in ecological parameters and indicators [1,8–10].
- The data are useful for researching fisheries ecology, including studies of population numbers and size structure of dominant benthic herbivores in rocky reef ecosystems, commercial fishing impacts, and warming impacts on size structure and relative abundance [11].
- An unprecedented disease outbreak in Western Victoria during 2006–09 demonstrated the value of these surveys in estimating the extent and scale of mortalities along 300 km of coastline [12–14].
- The data presented here could also be used for exploring various approaches to standardization and trend analysis, assessments of stock responses to fishing, determining species interactions and changes in relative biomasses, as well as measuring interactions between shell size and abundance for abalone. The data can also be used in conjunction with catch and effort to fit various models of biomass such as surplus production models [15–16].

Objective

The data [2] were generated to provide fishery independent time series of i) relative abundance of blacklip abalone and the other main exploited sympatric invertebrates, urchins and periwinkles, ii) size structure of blacklip abalone populations, iii) cover-abundance of the main macroalgal vegetation, iv) semi-quantitative data about competitor and predator species, and v) physiographical aspects of their supporting subtidal rocky reef habitats, along the Victorian coastline adjacent to Bass Strait and the Tasman Sea. These data [2] were intended primarily as input to fisheries stock assessments underpinning scientific recommendations to inform management decisions aimed at ensuring sustainable levels of fishing mortality [8]. Secondarily, they have also provided information about the impacts of climate-driven changes on fisheries ecology, as illustrated in the paper by Holland et al. [1] about disruption of trophic interactions (Figs. 1–8 and Table 1).

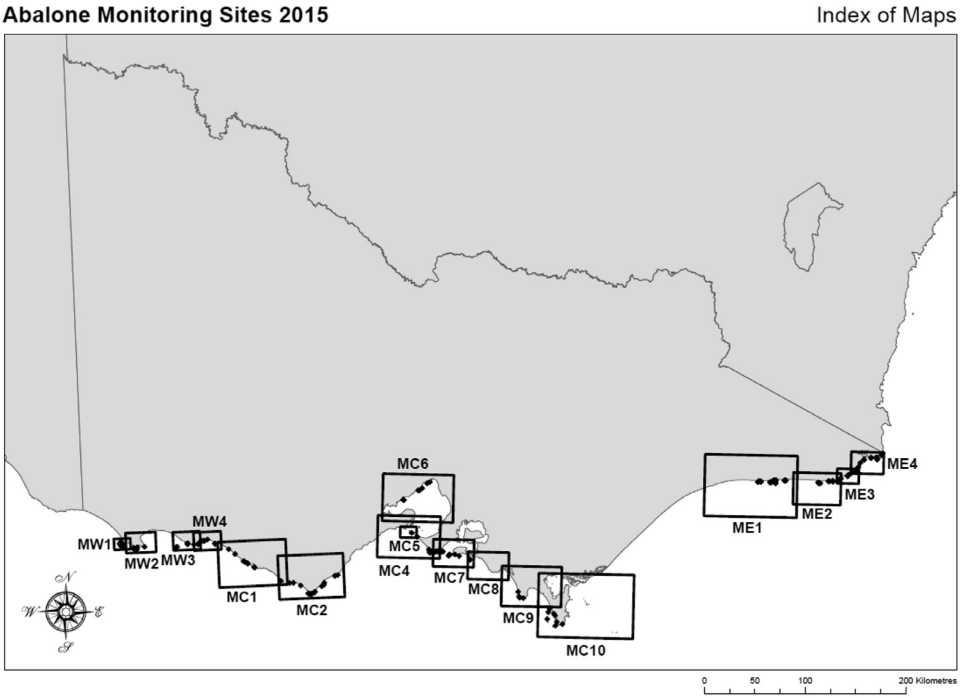

Fig. 1. Map of the State of Victoria, Australia showing the entire coast with fixed survey sites (as of 2015) as black diamonds distributed among 17 area maps bound by the labeled rectangles.

Table 1
Example of empirical application of blacklip abalone survey abundance (pre-recruit and recruit size categories) as performance indicators for each Spatial Management Unit (SMU) and the Central Zone fishery overall during 2018/19.

Spatial Management Unit (SMU)	Catch				Indicators							
	Total catch		Optimum targets 2018/19 t	SMU Category	Long-term indicators CPUE 2003/04 – 2018/19 Abundance 2003 – 2019				Short-term indicators CPUE 2009/10 – 2018/19 Abundance 2009 – 2019			
	'18/19 (t)	'18/19 (%)			Survey Sites '03	CPUE	Pre-recruits	Recruits	Survey Sites '18	CPUE	Pre-recruits	Recruits
Shipwreck Coast	31.6	11.6	28.7	M	10	-27%	-69%	-66%	8	-20%	+265%	+162%
Cape Otway	43.4	15.8	52.3	L	18	-26%	-54%	-63%	14	-18%	-15%	-21%
Surf Coast	0.8	0.3	1.4	S	0	+4%	-	-	0	+32%	-	-
Port Phillip Bay	0	0	0	S	7	-	-	-	0	-	-	-
Back Beaches	52.3	19.1	65.0	L	3	-23%	-80%	-67%	3	-13%	-53%	-66%
Flinders	32.3	11.8	30.0	M	25	-27%	-75%	-85%	19	-13%	-38%	-76%
Phillip Island	45.9	16.8	40.0	L	8	-25%	-47%	-66%	6	-19%	-23%	+4%
Kilcunda	14.0	5.1	12.1	S	0	-25%	-	-	0	-17%	-	-
Cape Liptrap	12.8	4.7	12.5	S	4	-36%	-80%	-93%	3	-31%	-66%	-87%
Prom Westside	26.0	9.5	20.0	S	4	-33%	-13%	-25%	4	-22%	+13%	+112%
Prom Eastside	8.1	3.0	7.0	S	0	-14%	-	-	0	-6%	-	-
Cliffy Group	6.5	2.4	5.0	S	0	-16%	-	-	0	-11%	-	-
Central Zone	273.8 t	100%	274.0 t		79	-24%	-61%	-55%	57	-13%	-16%	-27%

Notes: Coloured shading within the Total Catch column indicates whether catch has been caught within the Optimum Target, Threshold or exceeded the Limit. Green (within target range) indicates where catch was ±15% of the Optimum Target, Orange (within threshold range) indicates where catch was >±15% Optimum Target <±30%, Red (exceeding limit range) indicates where catch was >±30% of the Optimum Target for the 2018/19 quota year. Blue indicates no specific target allocation.

SMU catch categories (% of zone catch): Large ≥ 15%, 10% ≤ Medium < 15%, Small < 10%.

Long-term trend data collected from 2003 indicates the significance and direction of the trend: + = significant increase, - = significant decrease, black font = not significant. Short-term trend data indicate the percentage change in the indicator when comparing data collected in 2009/10 with data from 2018/19 (CPUE) of 2019 (pre-recruits and recruits) as a significant increase (+) or decrease (-), black font = not significant.

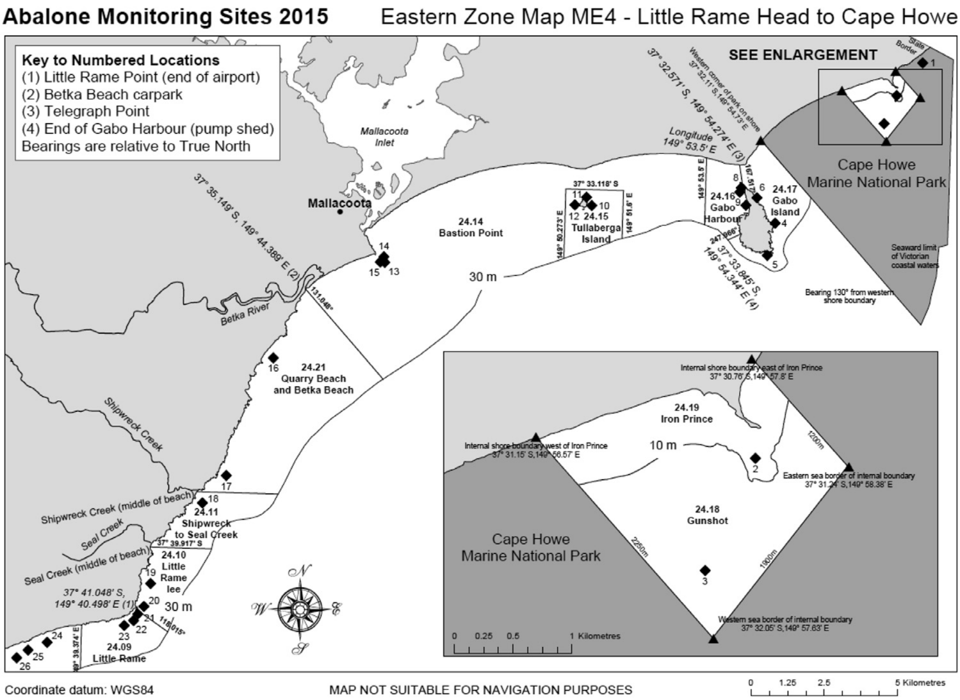

Fig. 2. One of the 17 maps identifying the locations for which the abalone monitoring datasets are provided – in this case, map ME4, the most easterly section of the approximately 2500 km long Victorian state coastline, where diamonds show fixed survey sites as of 2015 prior to subsequent reductions.

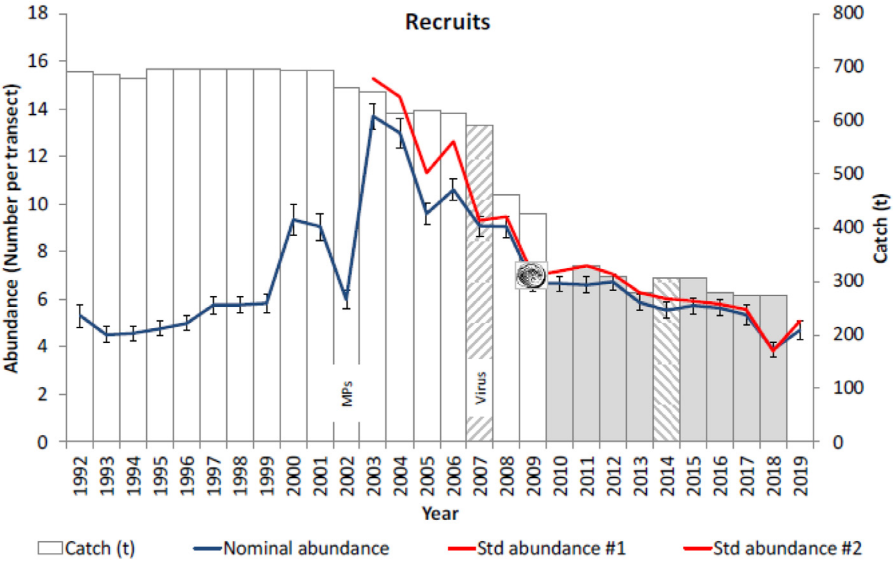

Fig. 3. Fishery independent legal-sized, blacklip abalone (recruits) abundance (nominal 1992–2019; standardised 2003–2019) including catch from 1992/1993–2018/19 in the Central Zone. Grey bars indicate relatively stable TACC around 280 t since 2010. Red = significantly decreasing standardised series; shell symbol = break point; hatched rising = increase in LML; and hatched declining = reduction in LML. MPs = introduction of Marine Parks. Virus = AVG first detected in the zone.

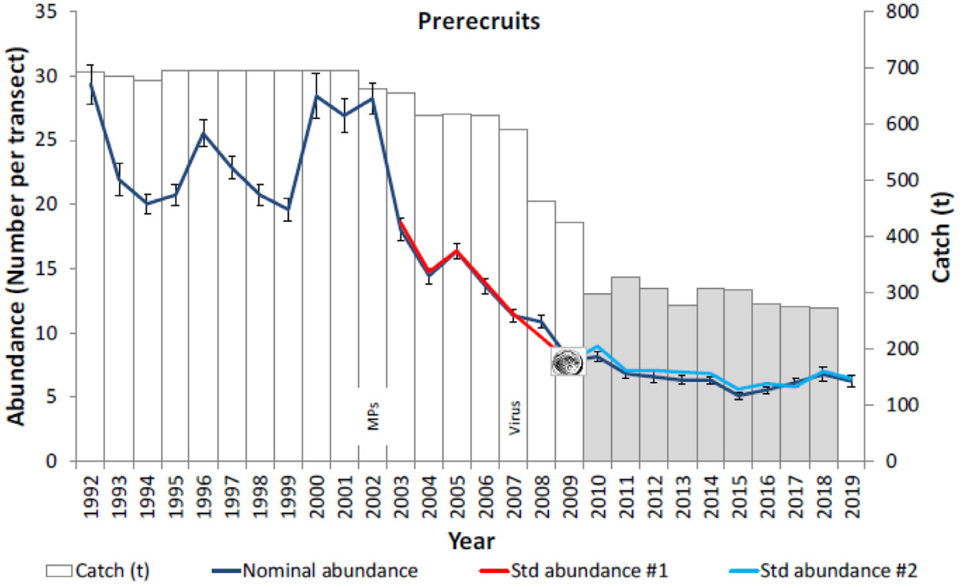

Fig. 4. Fishery independent sublegal-sized, non-juvenile, blacklip abalone (pre-recruits) abundance (nominal 1992–2019; standardised 2003–2019) including catch from 1992/1993–2018/19 in the Central Zone. Grey bars indicate period where the TACC was relatively stable at around 280 t since 2010. Red = significantly decreasing standardised series; light blue = non-significant; shell symbol = break or change point and #1 and #2 refer to trends either side; MPs = introduction of Marine Parks. Virus = AVG first detected in the zone.

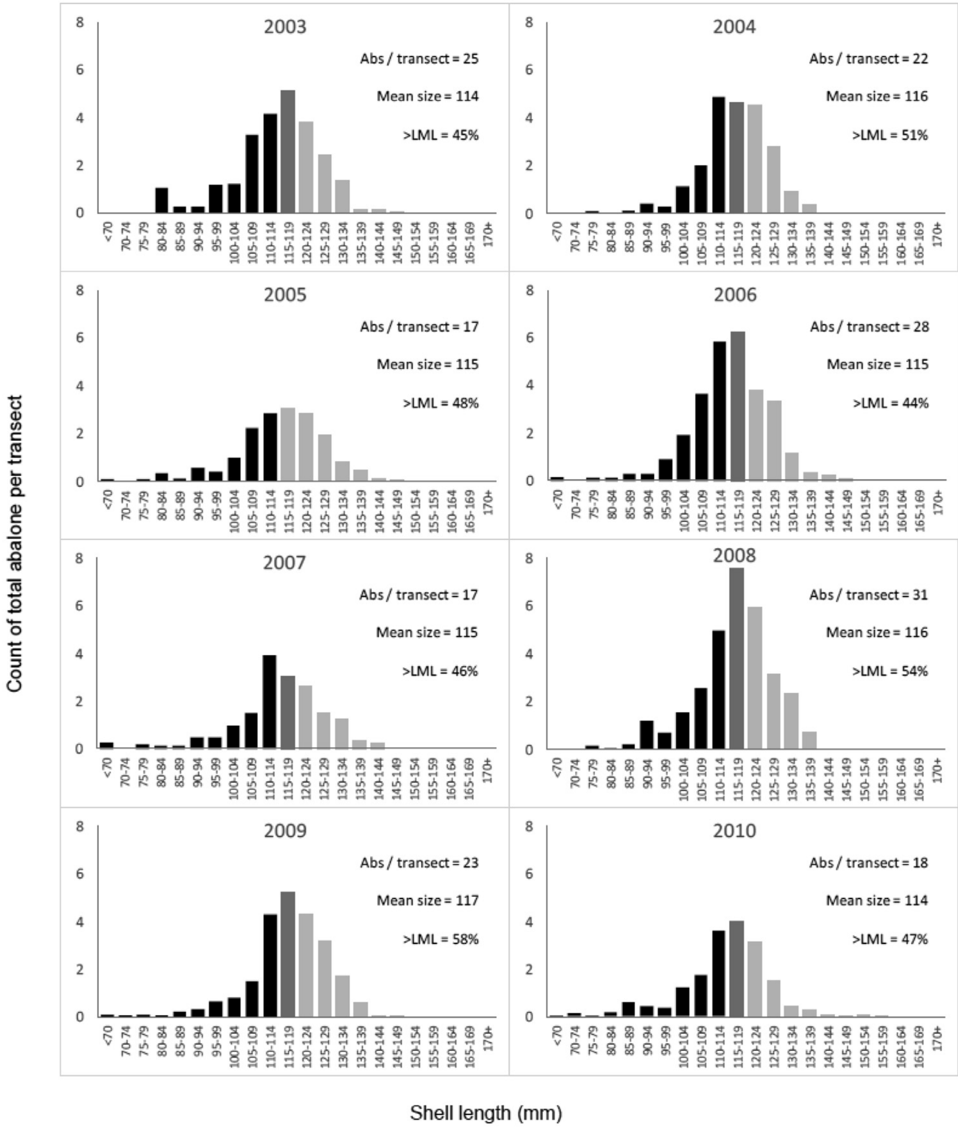

Fig. 5. Example: Size frequency distributions for the Back Beaches SMU from 2003 to 2010. Black bars represent undersized abalone, grey bars represent legal-sized abalone, dark grey bar is where the LML (117 mm) crosses the size category.

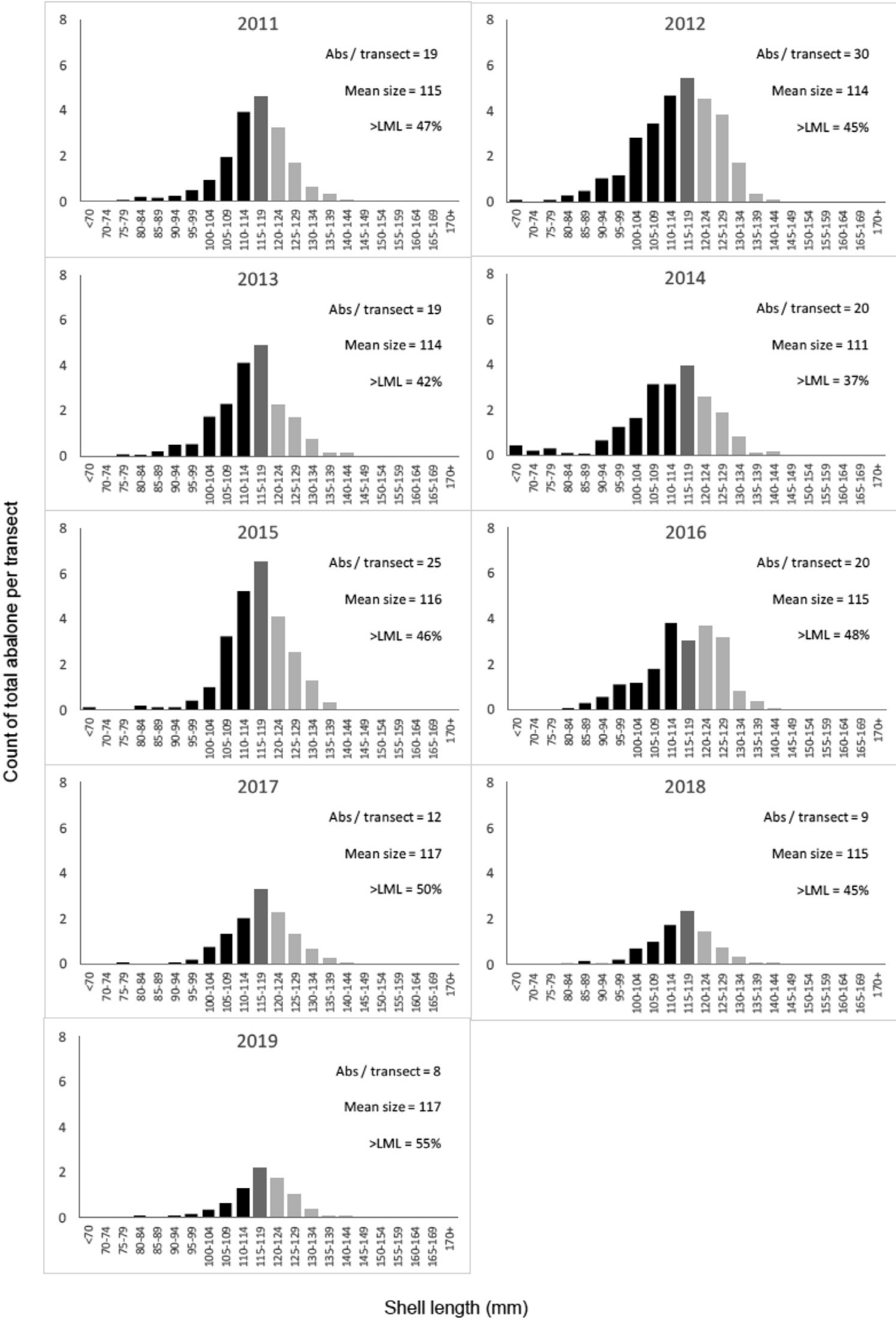

Fig. 6. Example: Size frequency distributions for the Back Beaches SMU from 2011 to 2019. Black bars represent undersized abalone, grey bars represent legal-sized abalone, dark grey bar is where the LML (117 mm) crosses the size category.

Fishery Independent Abalone Survey - Kina Diving Checked by contractor rep: Signed: ______________ Date: ___/___/20___

Location	Site # ____ Site name ______________________			Date: __________	Start: ________ h	Finish: ________ h
Diver	#			#		
Transect counts	1 Dir _____ °	2 Dir _____ °	3 Dir _____ °	4 Dir _____ °	5 Dir _____ °	6 Dir _____ °
• Recruit abalone						
• Pre-recruit abalone						
• Juvenile abalone						
• Empty ab shell						
• Black urchins						
Length Frequency (Log/Manual)	Qty: Min:	Qty: Min:	Qty: Min:	Qty: Min:	Qty: Min:	Qty: Min:
Location	Site # __________ Site name ______________			Date: __________	Start: ________ h	Finish: ________ h
Diver	#			#		
Transect counts	1 Dir _____ °	2 Dir _____ °	3 Dir _____ °	4 Dir _____ °	5 Dir _____ °	6 Dir _____ °
• Recruit abalone						
• Pre-recruit abalone						
• Juvenile abalone						
• Empty ab shell						
• Black urchins						
Length Frequency (Log/Manual)	Qty: Min:	Qty: Min:	Qty: Min:	Qty: Min:	Qty: Min:	Qty: Min:
Location	Site # __________ Site name ______________			Date: __________	Start: ________ h	Finish: ________ h
Diver	#			#		
Transect counts	1 Dir _____ °	2 Dir _____ °	3 Dir _____ °	4 Dir _____ °	5 Dir _____ °	6 Dir _____ °
• Recruit abalone						
• Pre-recruit abalone						
• Juvenile abalone						
• Empty ab shell						
• Black urchins						
Length Frequency (Log/Manual)	Qty: Min:	Qty: Min:	Qty: Min:	Qty: Min:	Qty: Min:	Qty: Min:

Note: do not leave any blank cells; write NA or Nil if the field does not apply or there are no data. "Log/Manual" strike one whichever does not apply.
Ver. 2021

Fig. 7. The most recent version (2021) of the datasheet used to record the relative abundance of blacklip abalone (*Haliotis rubra*) and long-spined sea urchin (*Centrostephanus rodgersii*) in six replicate transects at each fixed survey site annually.

Macroalgal Habitat Survey - Kina Diving *Checked by contractor rep: Signed:* ______________ *Date:* ___/___/20___

Location ______________________________ Site # ____ Site name ______________________________ Date: __________

Diver #						Diver #					
Kelp canopy %		Understorey algae %		Substrate %		Kelp canopy %		Understorey algae %		Substrate %	
Crayweed *(Phyllospora)*		Brown		Bare rock		Crayweed *(Phyllospora)*		Brown		Bare rock	
Elk kelp *(Ecklonia)*		Red		Pink crust		Elk kelp *(Ecklonia)*		Red		Pink crust	
String kelp *(Macrocystis)*		Green		Sand		String kelp *(Macrocystis)*		Green		Sand	
Bull kelp *(Durvillaea)*		Branching coralline		Epibiota		Bull kelp *(Durvillaea)*		Branching coralline		Epibiota	

Location ______________________________ Site # ____ Site name ______________________________ Date: __________

Diver #						Diver #					
Kelp canopy %		Understorey algae %		Substrate %		Kelp canopy %		Understorey algae %		Substrate %	
Crayweed *(Phyllospora)*		Brown		Bare rock		Crayweed *(Phyllospora)*		Brown		Bare rock	
Elk kelp *(Ecklonia)*		Red		Pink crust		Elk kelp *(Ecklonia)*		Red		Pink crust	
String kelp *(Macrocystis)*		Green		Sand		String kelp *(Macrocystis)*		Green		Sand	
Bull kelp *(Durvillaea)*		Branching coralline		Epibiota		Bull kelp *(Durvillaea)*		Branching coralline		Epibiota	

Location ______________________________ Site # ____ Site name ______________________________ Date: __________

Diver #						Diver #					
Kelp canopy %		Understorey algae %		Substrate %		Kelp canopy %		Understorey algae %		Substrate %	
Crayweed *(Phyllospora)*		Brown		Bare rock		Crayweed *(Phyllospora)*		Brown		Bare rock	
Elk kelp *(Ecklonia)*		Red		Pink crust		Elk kelp *(Ecklonia)*		Red		Pink crust	
String kelp *(Macrocystis)*		Green		Sand		String kelp *(Macrocystis)*		Green		Sand	
Bull kelp *(Durvillaea)*		Branching coralline		Epibiota		Bull kelp *(Durvillaea)*		Branching coralline		Epibiota	

Note: do not leave any blank cells; write NA or Nil if the field does not apply or there are no data. *Ver. 2021*

Fig. 8. The most recent version (2021) of the habitat datasheet used to record the cover abundance of dominant macroalgal species or phyla and substrate cover at each fixed survey site annually.

Data Description

The dataset comprises information about abalone, associated biota and habitat estimated during scientific surveys [2]. Specifically, data fields include:

- Year, day, and month when the sampling was performed
- Site number, and location where the survey occurred, including precise geographic coordinates
- Depth at site (m)
- Sea conditions
- Transect number and bearing
- Species counted or estimated (common English names),
- Number of abalone, periwinkles and urchins counted per transect
- Cover abundance (%) of macroalgae and encrusting algae
- Proportion of substrate and sand cover (%)
- Maximum shell dimension of each sampled abalone (mm)
- Topography (categorical)
- Juvenile abalone (categorical & relative abundance)
- Competitors and predators (categorical assignment)

Supplementary material: Juvenile monitoring in the Eastern Zone of the Victorian abalone fishery using abalone recruitment modules.

Experimental Design, Materials and Methods

The surveys were conducted annually by experienced research divers using surface supplied breathing apparatus (hookah) at up to 204 fixed monitoring stations (commonly referred to as sites), initially selected haphazardly on commercially productive reefs in the Victorian wild abalone dive fishery [8]. The fishery is limited entry, with minimum shell size limits, total allowable catch quotas and spatial catch caps regulated by the Victorian Government under the Victorian Fisheries Act 1995 and subordinate legislation. Catch and effort reporting is at the scale of designated reef codes (statistical reporting blocks) and the fishery is managed as three separate zones, Central (CZ), Eastern (EZ) and Western (WZ), with licenses and quota units allocated to a specific zone. The three zones span ~2500 km of coastline from the South Australian border in the west to the New South Wales border in the east with the CZ-WZ boundary located immediately east of the mouth of the Hopkins River at Warrnambool, and the CZ-EZ boundary at Lakes Entrance at the eastern end of the 90-Mile Beach. Regulation occurs at the management zone scale as well as subordinate spatial management units (SMU) which comprise 23 groupings of mainly contiguous reef codes.

Surveys of each station involved deploying a buoyed shot weight at a fixed GPS mark to provide divers with a secure anchor point on the seabed. The research vessel would then anchor so as to facilitate the safest access for the divers under the prevailing sea conditions, although surveys were not conducted during adverse weather or low underwater visibility conditions. Two divers operating independently descended the shot and counted all visible abalone encountered (they did not search cryptic spaces or turn over boulders) within belt transects of 30 m length and 1 m width, beginning from 5m distance from the shot weight. Each diver swam three replicates randomly assigned from 12 cardinal directions spaced by 30° arcs, each radiating along a marked rope attached to the shot weight, to provide a total of six replicates per fixed site for each survey. Until 2016, they also counted the numbers of urchins and periwinkles within each transect and recorded the cover abundance of the main macro algae (fucoids, kelps, rhodophytes and chlorophytes) and semi-quantitative categorizations of other competitor and predatory macro invertebrates as well as habitat features such as sand cover and reef topography. In addition, up to 25 abalone encountered at random were collected by swimming for up to 5 min away from the end of each transect and brought aboard the research vessel, pooled for each station, and their largest shell diameter recorded using a bespoke electronic measuring board [7]. As measuring proceeded during the survey at each station, the measured abalone were progressively returned to the seabed in bins and the research divers replaced the abalone onto the reef surface by hand to ensure they attached firmly to avoid predation.

The data comprises ~28,000 records from ~4500 site surveys conducted during 1992 to 2021. Although the fixed site design remained unchanged, the number of sites surveyed varied over time, mostly increasing in number periodically, and the survey method was refined on several occasions.

Although the survey method has been largely consistent, three different variants in the survey method have applied for both enumerating abalone abundance and measuring their shell size structure due to technological advancement. Method 1 (1992–1999) involved the removal of all abalone within each transect which were kept separate, brought aboard the research vessel and their shell lengths measured by manual caliper to provide both a count per transect and length frequency sample [4]; Method 2 (2000–2002) coinciding with a substantial increase in the number of sites, shifted from collecting to counting *in situ* and a separate collection of abalone was undertaken by each diver searching haphazardly on reefs adjacent to the circular area of 3850 m^2 bounded by the survey site. These two samples were pooled for each site and passed through an electronic measuring board which automatically recorded the maximum shell length [7]; whereas Method 3 (2003–2021), which accompanied a further increase in the number of sites, changed the protocol for length frequency sampling by requiring that divers spend up to a maximum of 5 minutes collecting the first 25 abalone they encounter by extending their traverse linearly along each of the six transect directions, and recording the time taken for each collection when it was less than 5 min [8]. This change was implemented after it became evident that haphazard collecting to measure shell length composition resulted in samples from some locations being skewed towards larger individuals, which affected the splitting of the total count into juvenile, pre-recruit, and recruit size categories. In addition, to avoid biasing the abundance estimates, in Method 3 the total count of abalone in each transect was replaced with counting the three size categories separately [8].

The abundance counts were standardized using a Bayesian generalized linear mixed model (GLMM) to test for interannual trends whilst allowing for inherent differences among sites, divers, and their interactions. Sufficient documentation is provided to reproduce the GLMM and select the most parsimonious combination of explanatory variables in each instance [8].

Ethics Statement

Not applicable, because data acquisition does not involve working with humans or conducting animal experiments.

CRediT Author Statement

Harry Gorfine: original idea, supervision, conceptualization, survey design, methodology, writing; **Justin Bell**: data conversion and analysis, data standardization, methodology, writing; **Michael Cleland**: SQL database development, data curation; **Khageswor Giri**: statistical advice and testing of standardization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships which have or could be perceived to have influenced the work reported in this article.

Data Availability

Abalone-FIS (Original data) (GitHub).

Acknowledgments

Collection and curation of these monitoring datasets was funded by the Victorian Fisheries Authority and its predecessor regulatory agencies of the Victorian State Government, Australia. The authors were funded as either Victorian Government employees or its contractors.

References

[1] O. Holland, M.A. Young, C.D.H. Sherman, M.H. Tan, H. Gorfine, T. Matthews, A.D. Miller, Ocean warming threatens key trophic interactions supporting a commercial fishery in a climate change hotspot, Glob. Change Biol. 27 (2021) 6498–6511, doi:10.1111/gcb.15889.
[2] Dataset https://github.com/Ekologas/Abalone-FIS doi:10.52081/zenodo.7053408
[3] S. Mayfield, C. Mundy, H. Gorfine, A.M. Hart, D. Worthington, Fifty years of sustained production from Australia's abalone fisheries, Rev. Fish. Sci. Aquac. 20 (2012) 220–250, doi:10.1080/10641262.2012.725434.
[4] H.K. Gorfine, D.A. Forbes, A.S. Gason, A comparison of two underwater census methods for estimating the abundance of the commercially important blacklip abalone, *Haliotis rubra*, Fish. Bull. 96 (3) (1998) 438–450 https://spo.nmfs.noaa.gov/content/comparison-two-underwater-census-methods-estimating-abundance-commercially-important. (accessed 24 December 2022).

[5] A.M. Hart, H.K. Gorfine, Abundance estimation of blacklip abalone (*Haliotis rubra*) II. A comparative evaluation of catch-effort, change-in-ratio, mark-recapture and diver-survey methods, Fish. Res. 29 (1997) 171–183, doi:10.1016/S0165-7836(96)00529-2.

[6] A.M. Hart, H.K. Gorfine, M.P. Callan, Abundance estimation of blacklip abalone (*Haliotis rubra*) I. An analysis of diver-survey methods used for large-scale monitoring, Fish. Res. 29 (1997) 159–169, doi:10.1016/0165-7836(93)90108-J.

[7] SciElex Shellfish Measuring Board https://scielex.com.au/products/products.asp?ID=9&Category=, 2022 (accessed 24 December 2022).

[8] VFA, 2019. Victorian Abalone – Methods used for fishery assessment. Victorian Fisheries Authority Science Report Series No. 9. Victorian Fisheries Authority, Queenscliff, Victoria, Australia. 43 pp. https://github.com/Ekologas/Abalone-FIS/files/9485238/Abalone.Methods.Report.No.9.-.2019.pdf (accessed 24 December 2022).

[9] M.A. Young, K. Critchell, A.D. Miller, E.A. Treml, M. Sams, R. Carvalho, D. Ierodiaconou, Mapping the impacts of multiple stressors on the decline in kelps along the coast of Victoria, Australia, Divers. Distrib. 00 (2022) 1–22, doi:10.1111/ddi.13654.

[10] M. Young, E. Treml, J. Beher, M. Fredle, H. Gorfine, A. Miller, S. Swearer, D. Ierodiaconou, Using species distribution models to assess the long-term impacts of changing oceanographic conditions on abalone density in south east Australia, Ecography 43 (7) (2020) 1052–1064, doi:10.1111/ecog.05181.

[11] M.A. Jalali, M. Young, Z. Huang, H. Gorfine, D. Ierodiaconou, Modelling current and future abundances of commercial benthic invertebrates using bathymetric LiDAR and oceanographic variables, Fish. Oceanogr. 27 (6) (2018) 587–601, doi:10.1111/fog.12280.

[12] H.K. Gorfine, D.C. Bardos, B.L. Taylor, R.W. Day, K. Sainsbury, C. Dichmont, J.D. Prince, Rapid response to abalone virus depletion in western Victoria: information acquisition and reefcode assessment models. FRDC Project 2007-066 final report, Univ. Melbourne (2009) 72 https://www.fish.gov.au/Archived-Reports/2014/Documents/2014_refs/24.%202007-066%20Gorfine%20et%20al%20Virus%20reponseDLD.PDF. (accessed 24 December 2022).

[13] M.A. Jalali, D. Ierodiaconou, H. Gorfine, F. Christiansen, M. Young, Spatial abundance patterns and recruitment of a virus-affected commercial mollusc fishery, Fish. Manag. Ecol. 22 (2015) 472–487, doi:10.1111/fme.12145.

[14] S. Mayfield, R. McGarvey, H.K. Gorfine, H. Peeters, P. Burch, S. Sharma, Survey estimates of fishable biomass following a mass mortality in an Australian molluscan fishery, J. Fish Dis. 34 (4) (2011) 287–302, doi:10.1111/j.1365-2761.2011.01241.x.

[15] H. Gorfine, B. Taylor, M. Cleland, M. Haddon, A. Punt, D. Worthington, I. Montgomery, 2005. Development of a spatially-structured model for stock assessment and TAC decision analysis for Australian abalone fisheries. FRDC Project 1999-116 final report. Primary Industries Research Victoria, Marine and Freshwater Systems, Department of Primary Industries, Queenscliff, Victoria, Australia. 108 pp. https://www.frdc.com.au/sites/default/files/products/1999-116-DLD.PDF (accessed 24 December 2022).

[16] H.K. Gorfine, B.L. Taylor, T.I. Walker, Triggers and targets: What are we aiming for with abalone fisheries models in Australia? J. Shellfish Res. 20 (2) (2001) 803–811 https://www.biodiversitylibrary.org/item/18776#page/825/mode/1up. (accessed 24 December 2022).