

# Validation of Fishery Logbook data using Electronic Monitoring for Wren Fishing Pty Ltd

Report 1 – April 2025

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## 1. Introduction

Wren Fishing Pty Ltd is one of Australia's largest independent seafood producers, employing 32 staff with annual turnover of \$13 million. They are recognised as industry leaders in the uptake, development, and promotion of world's best practice fishing methods, practices, and gear development. Wren Fishing are the sole operators in the Queensland N12 fishery and hold 3 licences in the NT ONLF. In 2023 Wren Fishing underwent an MSC pre-assessment and in 2024 formally entered a Fishery Improvement Project (FIP) to achieve full MSC certification. To achieve full MSC certification, fisheries must meet and exceed MSC standards and criteria. MSC maintains rigorous evidence standards, through their Evidence Requirement Framework (ERF) to ensure fisheries provide clear and undeniable proof that they meet and exceed MSC criteria. Fisheries that achieve MSC are considered to operate at global best practice.

An action under the Wren Fishing FIP is implementing a voluntary logbook data validation program, to monitor fishing activity and to verify mandatory Fishery Logbook data. Wren Fishing with the assistance of experts from Charles Darwin University (CDU) and the broader FIP stakeholder group developed an independent camera-based Electronic Monitoring (EM) validation program. CDU have been engaged for two fishing seasons to analyse and validate logbook data using EM data for (i) retained species, (ii) Endangered, Threatened, or Protected (ETP) species interactions, and (iii) discards. This report compares EM and Fishery Logbook reporting of catch numbers for these groups for the period of 12/04/2024 to 07/10/2024, as part of the 2024-2025 fishing season in the Gulf of Carpentaria Inshore Finfish Fishery (GoCFFFF; FIP Unit of Assessment 1).

## 2. Methods

### 2.1. Fishing Activity

The Wren Fishing fleet consists of 3 vessels: Felix the Cat, Enterprise, and Vixen II. For the report period (12/04/2024 to 07/10/2024), all three vessels operated within the Queensland Gulf of Carpentaria Inshore Fin Fish Fishery (GoCFFFF) under the N12 Fishery Symbol. The

N12 fishery area corresponds to UoA 1 under the Wren Fishing FIP. For all fishing operations, vessels used monofilament pelagic gillnets ranging from 1,500 to 1,800 m long with a mesh size of 165.2 mm and drop of 80 meshes.

## **2.2. Focal Species and Groups**

Validation of their Fishery Logbook data using EM has been conducted for (i) retained species, (ii) Endangered, Threatened, or Protected (ETP) species interactions, and (iii) discards in this report. A summary of the species and groups considered within each of these categories is provided below.

### **2.2.1. Retained species**

Under the N12 Fishery Symbol, the primary teleost target is Grey Mackerel, with other retained species including Spanish Mackerel, King and Blue Threadfin, Giant Queenfish, and Scaly and Black Jewfish (Table 1). Blacktip Whalers, a complex of two species (Australian Blacktip Shark and Common Blacktip Shark), are the primary shark target, along with a number of other Carcharhinid shark species, such as Spot-tail Sharks, Pigeye and Bull sharks, Blacktip Reef Sharks, Creek Whalers, and Graceful Sharks. Fishers can also retain Milk Sharks, Fossil Sharks and Weasel Sharks, but these are typically discarded.

### **2.2.2. Endangered, threatened, and protected species**

In Queensland, endangered, threatened, and protected (ETP) species are referred to as Species of Conservation Concern (SoCC) or Threatened, Endangered and Protected species (TEPS). Under the N12 Fishery Symbol, this includes a number of species of sharks, rays, marine mammals, and marine reptiles (Table 1). Any interactions with these animals must be recorded in mandatory logbooks, along with their fate. An interaction is classified as physical contact between the animal and a person, boat or fishing apparatus involved in a fishing operation. All ETP animals caught must be released.

Of note, Kuhl's Devil Ray (*Mobula kuhlii*) is considered a SoCC in the GoCIIFFF; however, the taxonomy of this species is currently unclear. It has been considered previously synonymous with the Longhorned Pygmy Devil Ray (*M. eregoodoo*), and scientific advice provided at the time of the most recent Ecological Risk Assessment for the GoCIIFFF suggests that the two species should be treated the same until their status can be clarified (Jacobsen et al., 2021). Therefore, individuals of either species may be reported Kuhl's Devil Ray in Fishery Logbooks, and as such we report interactions with both species as ETP interactions in this report.

### **2.2.3. Discards**

Hammerhead Shark were considered a Species of Conservation Concern in the most recent Ecological Risk Assessment for the GoCIIFFF (Jacobsen et al., 2021), but are not currently required to be reported as ETP interactions in mandatory logbooks. However, as of January 2024, all species of Hammerhead Sharks are considered "no-take" in Queensland fisheries and are required to be discarded and reported in logbooks (Table 1). Other discards reported in Fishery Logbooks are under an 'Other shark and ray' category. Discards of teleost fish are not currently required to be reported.

Table 1. Retained, Endangered, Threatened and Protected (ETP) species interactions, and reported discards in the Gulf of Carpentaria Inshore Finfish Fishery. \* indicates species that are considered “Species of Interest” due to additional reporting requirements. \*\* Taxonomic uncertainty with Kuhl’s Devil Ray.

Classification	Common name	Species name
<b>Retained species</b>		
Teleosts	Grey Mackerel	<i>Scomberomorus semifasciatus</i>
	Spanish Mackerel*	<i>Scomberomorus commerson</i>
	King Threadfin	<i>Polydactylus macrochir</i>
	Cobia	<i>Rachycentron canadum</i>
	Barred Javelin	<i>Pomadasys argenteus</i>
	Other teleosts include	
	Spotty Mackerel	<i>Scomberomorus munroi</i>
	Blue Threadfin	<i>Eleutheronema tetradactylum</i>
	Giant Queenfish	<i>Scomberoides commersonianus</i>
	Pomfret	<i>Parastromateus niger</i>
Sharks	Blacktip Whalers	
	Australian Blacktip Shark	<i>Carcharhinus tilstoni</i>
	Common Blacktip Shark	<i>Carcharhinus limbatus</i>
	Graceful Shark	<i>Carcharhinus amblyrhynchoides</i>
	Milk, sharknose and hardnose sharks	<i>Rhizoprionodon acutus, R. taylori, Carcharhinus macloti</i>
	Spot-tail Shark	<i>Carcharhinus sorrah</i>
	Spinner Shark	<i>Carcharhinus brevipinna</i>
	Creek Whaler	<i>Carcharhinus fitzroyensis</i>
	Pigeon & Bull Sharks	<i>Carcharhinus amboinensis, C. leucas</i>
	Blacktip Reef Shark	<i>Carcharhinus melanopterus</i>
	Fossil & Weasel Sharks	<i>Hemipristis elongata, H. australiensis</i>
	<b>Endangered, Threatened, and Protected species</b>	
Marine Reptiles	Green Turtle	<i>Chelonia mydas</i>
	Loggerhead Turtle	<i>Caretta caretta</i>
	Hawksbill Turtle	<i>Eretmochelys imbricata</i>
	Flatback Turtle	<i>Natator depressus</i>
	Olive Ridley Turtle	<i>Lepidochelys olivacea</i>
	Leatherback Turtle	<i>Dermochelys coriacea</i>
	Sea Snakes	Family Elapidae
Marine Mammals	Estuarine Crocodiles	<i>Crocodylus porosus</i>
	Dugong	<i>Dugon dugong</i>
	Australian Humpback Dolphin	<i>Sousa sahulensis</i>
	Australian Snubfin Dolphin	<i>Orcaella heinsohni</i>
	Common Bottlenose Dolphin	<i>Tursiops aduncus</i>
	Indo-Pacific Bottlenose Dolphin	<i>Tursiops truncatus</i>
	False Killer Whale	<i>Pseudorca crassidens</i>
	Spinner Dolphin	<i>Stenella longirostris</i>
	Speartooth Shark	<i>Glyphis glyphis</i>
	Rays	Reef Manta Ray
Giant manta ray		<i>Mobula birostris</i>
Kuhl’s Devil Ray		<i>Mobula kuhlii</i>
Longhorn Pygmy Devil Ray**		<i>Mobula eregoodoo</i>
Bentfin Devilray		<i>Mobula thurstoni</i>
Giant Devilray		<i>Mobula mobular</i>
Large-tooth Sawfish		<i>Pristis pristis</i>
Narrow Sawfish		<i>Anoxypristis cuspidata</i>
Green Sawfish		<i>Pristis zijsron</i>
Dwarf Sawfish		<i>Pristis clavata</i>
<b>Discards</b>		
Hammerheads (no-take)	Great Hammerhead Shark	<i>Sphyrna mokarran</i>
	Scalloped Hammerhead Shark	<i>Sphyrna lewini</i>
Other shark and rays	Winghead Shark	<i>Eusphyra blochii</i>
		Subclass Elasmobranchii

## 2.3. Data collection

### 2.3.1 Fishery Logbooks

Licensed commercial fishers operating in Queensland are legally required to complete daily catch and effort logbooks for each vessel. These must be completed every calendar day a vessel is at sea, including when fishing or not. When fishing under the N12 symbol, a vessel may conduct multiple fishing shots across a single night, with catch data aggregated into a single logbook entry for the given calendar date (herein 'daily shot').

For the GoCIFFF, fishers are required to complete 3 Fishery Logbooks (Appendix 1):

1. **Gulf of Carpentaria net fisheries logbook**, which captures all teleost catch information (number, weight, and form (fillet or whole)), as well as fishing information including license number, vessel details, fishery symbol used, fishing gear used, date, and location.
2. **Queensland shark and ray fishery logbook**, which captures all shark and ray catch information (number, weight and form (trunk or whole)) for all species and discard information for Hammerhead Shark species and Other shark and ray category, as well as the license number, vessel details, fishing gear used, date, and location.
3. **Threatened, endangered and protected animal logbook** (ETP logbook), which includes details of any interaction with an ETP species.

Copies for all available logbooks for the three Wren Fishing vessels across the reporting period were provided to CDU and digitised into excel for validation.

### 2.3.2 Electronic Monitoring

The three Wren Fishing vessels were fitted with two Archipelago PoE cameras each in early-2024: one positioned to cover the hauler and one to cover the deck, to provide full coverage of the working area of each vessel. Each camera had a 90° horizontal, 70° vertical, and a 130° diagonal field of view, with a 2.8 mm focal length. Cameras recorded at a resolution of 1920 x 1080 pixels at a rate of 5 frames per second.

The Archipelago system features a digital pressure sensor that automatically activates when the net drum is engaged and stops recording approximately 5 minutes after the net drum disengages. Footage is recorded onto an interchangeable memory drive within the system's main control module, and along with the footage, the system records GPS location and date and time data.

Copies of all available EM footage was provided to CDU on portable memory drives for the purposes of validating Fishery Logbooks.

### 2.3.3 Review Process

A threshold of 10% of daily shots per vessel per trip was selected for review to validate Fishery Logbooks with EM. A 10% review threshold was selected to be in alignment with the Australian Fisheries Management Authority Electronic Monitoring Program (Australian

Fisheries Management Authority, 2024), ensuring a representative sample of fishing activity is reviewed while balancing cost-effectiveness and feasibility.

For Wren Fishing operations, daily shots include up to 2 nighttime fishing shots per day. A trip was defined as the period of time a vessel was at sea between returns to base where EM footage could be offloaded. The 10% of required daily shots were randomly selected within trips for each vessel, and the associated EM footage was then randomly assigned to one of two trained observers for review.

Review of EM footage for each daily shot involved recording the start and end time and GPS locations, and complete catch composition and fate per fishing shot, which was then aggregated to reflect the daily shot and align with Fishery Logbooks. The start of the shot was defined as the moment the net first passed the drum on retrieval. The shot ended when the net anchor was landed on the vessel deck. Recording of the full catch composition included recording every individual animal that could be seen interacting with the fishing operation to the lowest possible taxonomic level, with scientific names, common names, and Codes for Australian Aquatic Biota (CAAB code) recorded. These were further categorised as retained, discards, or ETP species. The fate of each animal was recorded as “retained”, “release alive” (clear signs of life, such as body, mouth or gill movements), “release dead” (no visible signs of life), “release injured” (clear signs of injury, such as wounds or blood), “release unknown” (unable to determine if alive or dead on release), or “unknown”. Any animal that remained on the deck of vessel at the end of a fishing shot (when footage ended) was considered retained, which was confirmed by Wren Fishing. For validating Fishery Logbooks, animals retained were categorised as ‘retained species’, any ETP species interacted with in any way were classed as ‘ETP species interactions’, and any non-ETP species released in any condition were considered ‘discards’.

## **2.4. Statistical analysis**

### **2.4.1. Logbook Validation**

Retained animals recorded in the ‘Gulf of Carpentaria net fisheries logbook’ and ‘Queensland shark and ray fishery logbook’, and ETP species interactions recorded in the ‘Threatened, endangered and protected animal logbook’, were directly validated between EM footage and Fishery Logbooks (see Appendix 1). Discards, however, are only recorded for sharks and rays, including Hammerhead Shark species (no-take) to the species level and under a general ‘Other shark & ray’ category in the ‘Queensland shark and ray fishery logbook’. Discards for teleosts are not recorded in any Fishery Logbook. Therefore, only discards of Hammerhead Shark species and ‘Other sharks & rays’ could be validated. While teleost discards could not be validated, these discards are quantified directly from EM footage for each daily shot reviewed.

Congruence between Fishery Logbook data and EM data was assessed at the daily shot level by calculating the difference in reported counts (EM minus logbook) for each species or species group reported in logbooks (see Appendix 1). These differences were averaged across reviewed shots at the vessel and entire fleet level to estimate the mean difference and associated 95% confidence intervals. To account for variation in catch magnitude among species, shots, vessels

and trips, we also calculated the mean difference in counts as a proportion of average catch at the vessel and fleet level. This was done by dividing the mean difference by the average number of individuals reported caught per shot, then multiplying by 100 to express the result as a percentage. This measure provides a more meaningful indicator of congruence, as a small absolute difference may be relatively large or small depending on the catch size. For both the mean difference in counts and mean difference in counts as a proportion of average catch, a value of 0 indicates perfect agreement between EM and logbook counts. Positive values indicate that EM recorded more individuals than the logbook, suggesting potential under-reporting in logbooks. Negative values indicate that EM recorded fewer individuals than the logbook, suggesting potential over-reporting in logbooks.

For ETP species, fate is also required to be recorded in the Threatened, endangered and protected animal logbook as ‘number dead’, ‘number alive and uninjured’, or ‘number alive but injured’. EM data were used to validate these fate records for all ETP interactions recorded. It should be noted, however, that in determining the fate of animals from EM footage, several challenges arise due to the limitations of the camera system and coverage. The camera position and clarity can limit an EM observer’s ability to accurately assess subtle behavioural indicators such as gill or spiracle movement, which are often crucial for determining whether an animal is alive or dead. This is particularly problematic when animals undergo long interactions, including entanglement in nets, which can lead to fatigue and make it harder to assess their condition. Additionally, since no EM footage is available at the release point over the water, observers cannot confirm whether an animal actively swam away after release. These limitations mean that interpreting fate from EM can be imprecise, and results reported here should be considered with caution.

#### **2.4.2. Species of Interest**

Under the Queensland Harvest Strategy, catch rates of Spanish Mackerel (*Scomberomorus commerson*) are to be monitored. Similarly, interactions with ETP species are also of particular interest to fisheries managers. To provide additional information on these species, total catches and catch locations for Spanish Mackerel and ETP species were extracted from all available Fishery Logbooks for the report period, not only those selected for validation. These data were then used to generate density heatmaps using a Kernel Density Estimation, to identify spatial hotspots of interactions across fishing operations.

### **3. Results**

#### **3.1. Electronic Monitoring Review**

Across the 6-month reporting period (12/04/2024 - 07/10/2024), the three vessels fished for a combined total of 267 days (Table 2). Felix the Cat completed four trips, accounting for 140 fishing days, while the Enterprise and Vixen II completed two trips each, with 65 and 61 fishing days, respectively.

Overall, 9.74% of all recorded daily shots were reviewed using EM (Table 2). While a review threshold of 10% of daily shots per vessel per trip was targeted, technical issues with the camera

system on Felix the Cat for one trip resulted in only one daily shot where complete footage was available. Excluding this trip, 11.57% of all daily shots were reviewed across the fleet.

*Table 2. Summary of daily shots conducted and reviewed through electronic monitoring across the reporting period by vessel within the Gulf of Carpentaria Inshore Fin Fish Fishery.*

Vessel	Trip ID	Trip Dates	Daily shots reviewed	Total daily shots	Percentage reviewed
Enterprise	Enterprise1	12/04/2024 - 18/05/2024	2	14	14.29%
Enterprise	Enterprise2	21/06/2024 - 09/06/2024	6	51	11.76%
Felix the Cat	Felix1	09/07/2024 - 24/07/2024	4	37	10.81%
Felix the Cat	Felix2	09/07/2024 - 16/08/2024	2	16	12.50%
Felix the Cat	Felix3	07/08/2024 - 16/08/2024	4	37	10.81%
Felix the Cat	Felix4	15/08/2024 - 07/10/2024	1	51	1.96%
Vixen II	Vixen1	15/08/2024 - 07/10/2024	1	9	11.11%
Vixen II	Vixen2	15/08/2024 - 07/10/2024	6	52	11.54%
<b>Total</b>			<b>26</b>	<b>267</b>	<b>9.74%</b>

A total of 26 daily shots were analysed, encompassing 70.9 hours of EM footage, with an average individual shot duration of 2.8 hours ( $\pm 0.3$  hours SE). The average review time was 6.2 hours ( $\pm 1.5$  hours SE) per daily shot. However, the first 9 videos were reviewed at a slower pace as a screenshot was taken for every animal to confirm species. After refining the methodology, review efficiency improved significantly, with the remaining footage reviewed in an average of 3.7 hours ( $\pm 0.6$  hours) per daily shot (mean time of 3.0 hours  $\pm 0.3$ ). Review time varied with catch size, with larger catches requiring longer analysis.

### **3.1.2 Spatial Distribution**

Fishing activity was concentrated along the western coast of Cape York during the reporting period, with daily shots selected for review and validation being relatively evenly distributed across fishing efforts (Figure 1). An inconsistency was identified in one Fishery Logbook, where the fishery grid (location) positioned the shot on land. However, this logbook was not randomly selected for validation.

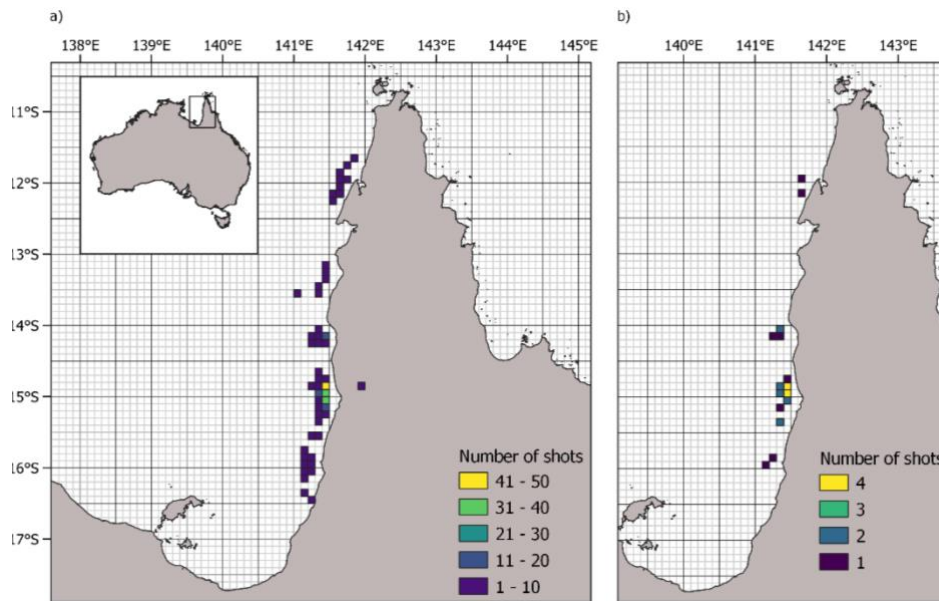


Figure 1. Distribution of a) daily shots conducted based on Fishery Logbook data, and b) daily shots reviewed for validation across fishery grid cells, represented by the number of shots recorded per grid cell. Darker shades indicate lower fishing effort, while lighter shades represent areas of higher fishing activity. The inset map shows the location of the fishing area within northern Australia, highlighted by the black rectangle

## 3.2. Logbook Validation

### 3.2.1. Retained catch

The primary retained teleost was Grey Mackerel, which had the highest reported catches across the fleet (mean  $\pm$  SE:  $274.2 \pm 67.3$  individuals; Table 3). EM recorded slightly more individuals than logbooks, with a mean difference of  $3.7 \pm 8.4$  individuals, representing only a 1% discrepancy and demonstrating good agreement between EM and logbook data (Figure 2). This was consistent across vessels (Table A1 in Appendix 2). In contrast, Spanish Mackerel, were recorded in higher numbers in Fishery Logbooks than by EM with a mean difference of  $-1.3 (\pm 4.1)$  individuals (Figure 2). This may be driven by challenges in differentiating between Mackerel species from EM footage. Despite this, the discrepancy represented a small proportion of average catch (-14%) indicating good agreement between logbook and EM data (Table 3). Further, as a group, the discrepancy for Mackerel was very low (1% proportional difference; Table 3).

All other teleost species were caught in low average numbers, with Pomfret and Giant Queenfish reported in higher numbers in EM compared with logbooks, with high mean differences ( $36.1 \pm 17.5$  and  $14.1 \pm 17.5$  individuals, respectively), indicating underreporting in logbooks for these species. This is confirmed when assessing data at the vessel level, with catches of these species only being reported in EM data (i.e., positive mean differences with no 95% confidence intervals indicate reporting in EM only; Table A1 in Appendix 2). All other teleost fishes were reported to have low mean differences, and while proportionate differences were high for many, this is confounded by low average catch numbers.

Among retained sharks and rays, Blacktip Whalers were caught in the highest numbers, with an average of  $38.2 \pm 14.4$  individuals per daily shot (Table 3). Numbers were higher in EM than in logbooks overall, with a mean difference of  $31.8 \pm 32.1$  individuals and proportional difference of 83%, indicating overall low agreement between logbooks and EM (Table 3; Figure 3), and potential under-reporting in logbooks. All other sharks were caught in relatively low numbers with varying degrees of discrepancy between logbooks and EM data. A few elasmobranch species showed higher counts in logbooks compared to EM, including Pigeye & Bull Sharks (mean difference =  $-2.0 \pm 1.7$ ; -74%) and Blacktip Reef Shark ( $-1.5 \pm 3.4$ ; -107%), while all others were recorded in higher numbers in EM (Figure 3). At the vessel level, catches for some species and groups were only recorded in EM, including Milk and Hardnose Sharks, Spinner Sharks, Blacktip Reef Sharks, Creek Whalers, and Fossil and Weasel Sharks (Table A1 in Appendix 2), indicating high levels of under-reporting in logbooks for these species. Given the majority of shark and ray catches are of Whaler Sharks within the *Carcharhinus* genus, issues with misidentification between species for fishers and EM observers may occur due to similarities between a number of these species, which may drive discrepancies. However, when considering reported catches for Carcharhinid sharks overall, the discrepancy remained high, with a mean difference of  $16.4 (\pm 16.9)$  individuals across an average catch of  $24.1 (\pm 7.8 \text{ SE})$  per daily shot (Table 3), reflecting a proportionate difference of 68%. Collectively, this suggests that Carcharhinid sharks are likely being under-reported in logbooks, which is driven by a lack of reporting of Whaler and other shark species by each vessel (Table A1 in Appendix 2).

Table 3. Mean difference in counts ( $\pm 95\%$  confidence interval) between EM and Fishery Logbooks, average number (from EM and Fishery Logbooks) reported caught per daily shot, mean difference in counts as a percentage of average catch for retained catch across Wren Fishing fleet for time period reviewed.

Species	Scientific Name	Mean difference in counts	Average number reported ( $\pm$ SE)			Mean difference in counts as proportion of average catch
		( $\pm 95\%$ CI)	EM	Fishery Logbooks	All catch	
<b>Teleosts</b>						
Grey Mackerel	<i>Scomberomorus semifasciatus</i>	3.7 ( $\pm$ 8.4)	276.0 (68.8)	272.3 ( $\pm$ 67.2)	274.2 ( $\pm$ 67.3)	1%
Pomfret	<i>Parastromateus niger</i>	36.1 ( $\pm$ 17.5)	36.1 ( $\pm$ 8.3)	0	18.0 ( $\pm$ 7.2)	201%
Teleost undifferentiated	Class Actinopterygii	21.7 ( $\pm$ 15.2)	21.7 ( $\pm$ 7.2)	0	10.8 ( $\pm$ 5.6)	201%
Spanish Mackerel	<i>Somberomorus commerson</i>	-1.3 ( $\pm$ 4.1)	8.4 ( $\pm$ 1.9)	9.7 ( $\pm$ 2.6)	9.1 ( $\pm$ 2.2)	-14%
Giant Queenfish	<i>Scomberoides commersonianus</i>	14.1 ( $\pm$ 17.5)	14.9 ( $\pm$ 8.0)	0.8 ( $\pm$ 0.4)	7.9 ( $\pm$ 5.9)	178%
Blue Threadfin	<i>Eleutheronema tetradactylum</i>	3.0 ( $\pm$ 25.4)	3 ( $\pm$ 2)	0	1.5 ( $\pm$ 1.7)	200%
Cobia	<i>Rachycentron canadum</i>	0.0 ( $\pm$ 1.1)	1	1 ( $\pm$ 0.4)	1.0 ( $\pm$ 0.3)	0%
Boofhead Catfish	<i>Sciades leptaspis</i>	1.5 ( $\pm$ 1.3)	15. ( $\pm$ 0.5)	0	0.8 ( $\pm$ 0.5)	188%
Barred Javelin	<i>Pomadasys argenteus</i>	1.0 ( $\pm$ 0.0)	1	0	0.5 ( $\pm$ 0.4)	200%
Threadfin undifferentiated	Family Polynemidae	15	15	0	7.5	200%
King Threadfin	<i>Polydactylus macrochir</i>	4	4	0	2	200%
Spotty Mackerel	<i>Scomberomorus munroi</i>	1	1	0	0.5	200%
<i>Mackerels Grouped</i>	<i>Scomberomorus</i> spp.	2.88 ( $\pm$ 8.3)	282.6 ( $\pm$ 69.8)	279.7 ( $\pm$ 68.0)	281.1 ( $\pm$ 68.2)	1%
<b>Sharks and rays</b>						
Blacktip Whalers	<i>Carcharhinus tilstoni</i> & <i>Carcharhinus limbatus</i>	31.8 ( $\pm$ 32.1)	54.1 ( $\pm$ 19.3)	22.3 ( $\pm$ 5.3)	38.2 ( $\pm$ 14.4)	83%
Spot-tail Shark	<i>Carcharhinus sorrah</i>	0.5 ( $\pm$ 4.9)	6.5 ( $\pm$ 3.1)	6 ( $\pm$ 1.4)	6.2 ( $\pm$ 2.4)	8%
Milk & Hardnose Sharks	<i>Rhizopriondon acutus</i> & <i>Carcharhinus macloti</i>	8.3 ( $\pm$ 7.6)	8.3 ( $\pm$ 3.6)	0	4.1 ( $\pm$ 2.7)	202%
Creek Whaler	<i>Carcharhinus fitzroyensis</i>	0.4 ( $\pm$ 5.9)	3.3 ( $\pm$ 1.7)	2.9 ( $\pm$ 1.4)	3.1 ( $\pm$ 1.6)	13%
Pigeys & Bull Sharks	<i>Carcharhinus amboinensis</i> & <i>Carcharhinus leucas</i>	-2.0 ( $\pm$ 1.7)	1.7 ( $\pm$ 0.7)	3.7 ( $\pm$ 1.0)	2.7 ( $\pm$ 0.9)	-74%
Carcharhinus undifferentiated	<i>Carcharhinus</i> spp.	5.3 ( $\pm$ 3.5)	5.3 ( $\pm$ 1.6)	0	2.6 ( $\pm$ 1.4)	204%
Blacktip Reef Shark	<i>Carcharhinus melanopterus</i>	-1.5 ( $\pm$ 3.4)	0.7 ( $\pm$ 0.3)	21.7 ( $\pm$ 1.0)	1.4 ( $\pm$ 0.8)	-107%
Spinner Shark	<i>Carcharhinus brevipinna</i>	1.0 ( $\pm$ 0.0)	1	0	0.5 ( $\pm$ 0.4)	200%
Fossil & Weasel Sharks	<i>Hemipristis elongata</i> & <i>Hemipristis australiensis</i>	1	1	0	0.5	200%
<i>Whaler Sharks Grouped</i>	<i>Carcharhinus</i> spp.	16.4 ( $\pm$ 16.9)	32.3 ( $\pm$ 10.6)	15.9 ( $\pm$ 3.0)	24.1 ( $\pm$ 7.8)	68%

\*Undifferentiated groups are animals which could not be confirmed to species level in electronic monitoring review only.

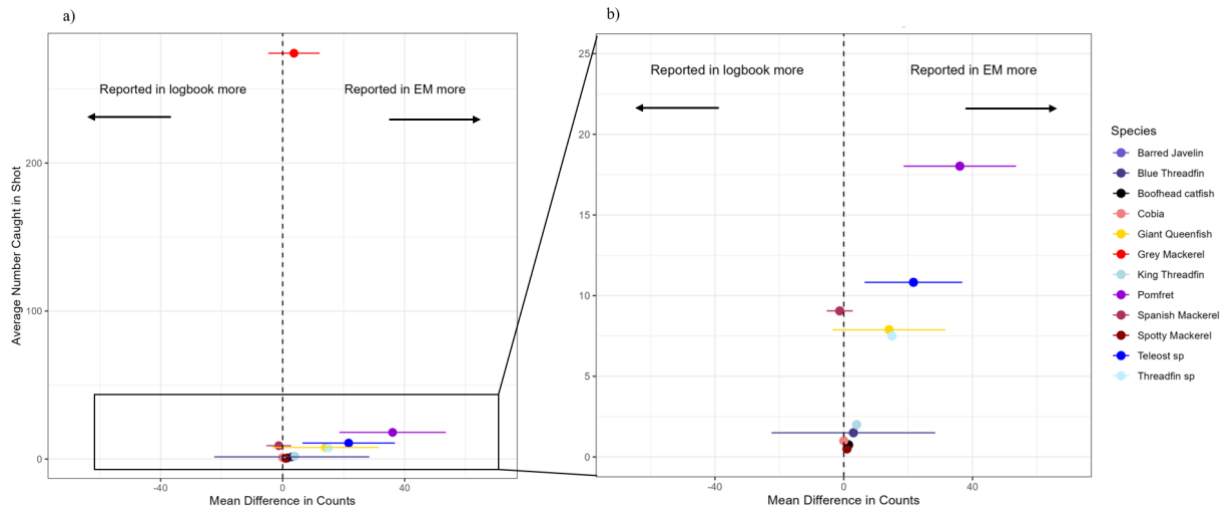


Figure 2. Mean differences in counts ( $\pm$  95% confidence interval) between Electronic Monitoring and Fishery Logbooks relative to the average catch of retained finfish across the Wren Fishing fleet for the period reviewed.

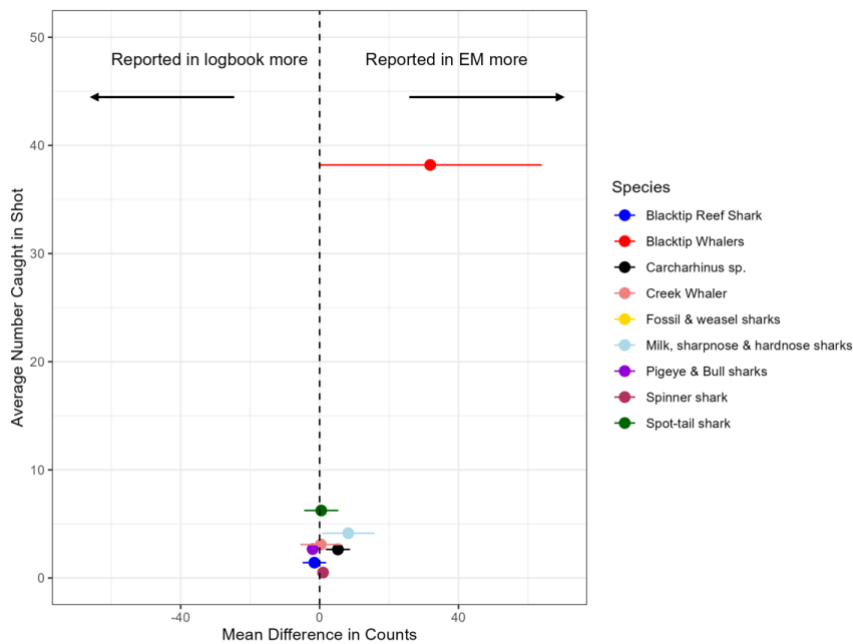


Figure 3. Mean differences in counts ( $\pm$  95% confidence interval) between Electronic Monitoring and Fishery Logbooks relative to the average catch of retained sharks and rays across the Wren Fishing fleet for the period reviewed.

### 3.2.1.1 Spanish Mackerel Interactions

A total of 1,694 Spanish Mackerel were reported in 184 of the total 267 daily shots captured in logbooks for the reporting period across the fleet (Table 4). By vessel, Vixen II reported the highest average catch per daily shot ( $13.7 + 2.2$  SE; Table 4).

Spanish Mackerel were primarily caught in three main areas closely aligned with regions of concentrated fishing effort during the reporting period (Figure 4). The lowest density of

reported catch occurred around 12°S, while the highest density was recorded around 15°S. It should be noted that these spatial patterns may reflect a combination of true species distribution and the uneven distribution of fishing effort, with higher catches occurring in areas where effort was most intense.

Table 4. Fishery Logbook reported catches for Spanish Mackerel by vessel across the Wren Fishing fleet for the period reviewed

Vessel	Number of daily shots with Spanish Mackerel (total shots)	Total Spanish Mackerel caught	Average number ( $\pm$ SE) reported caught
Felix the Cat	100 (141)	810	8.10 ( $\pm$ 0.99)
Enterprise	52 (65)	446	8.58 ( $\pm$ 1.14)
Vixen II	32 (61)	438	13.69 ( $\pm$ 2.21)

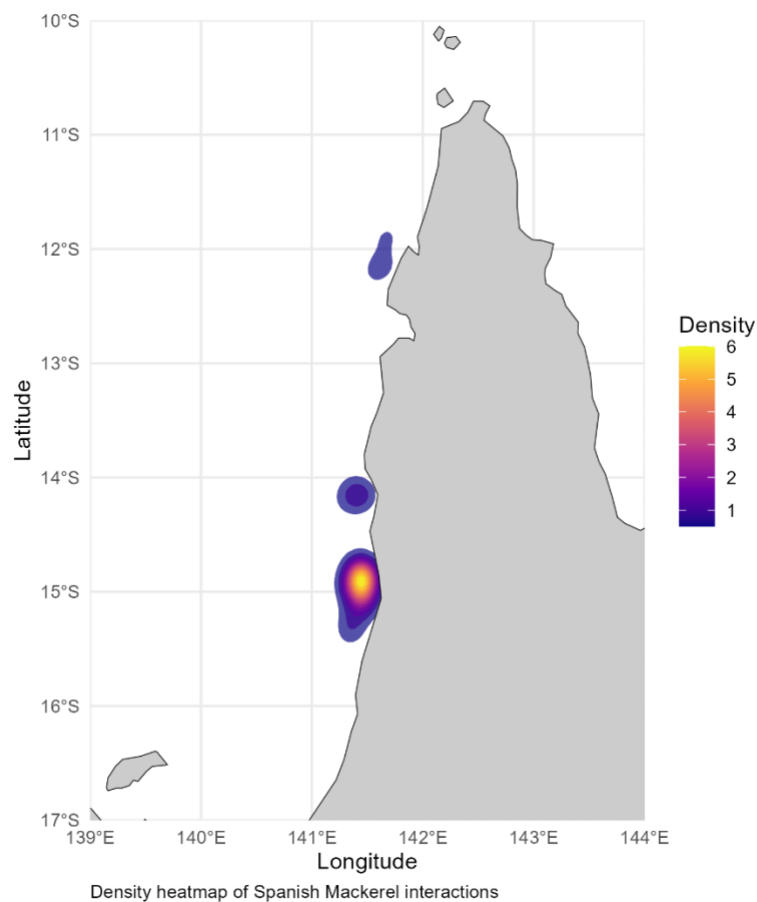


Figure 4. Density heatmap of Spanish Mackerel (*Scomberomorus commerson*) caught between 12/04/2024-7/10/2024 in the Gulf of Carpentaria Inshore Finfish Fishery.

### 3.2.3. Endangered, Threatened and Protected (ETP) species

#### 3.2.3.1. Logbook Validation

ETP interactions were reported in logbooks for 11 of the total 26 daily shots reviewed (4 of 8 for Enterprise, 5 of 11 for Felix, 2 of 7 for Vixen). ETP interactions occurred with 4 species: Hawksbill Turtle, Narrow Sawfish, Giant Manta Ray, and Longhorned Pygmy Devil Ray (Table 5; Figure 5). Felix the Cat was the only vessel to interact with Hawksbill Turtles, with 2 reported in both logbooks and by EM (Table 5). The highest number of ETP interactions

occurred with Narrow Sawfish, for which 14 were recorded in logbooks compared to 18 in EM (Figure 5). This discrepancy was driven by 2 Narrow Sawfish not reported for the Enterprise and 2 for Vixen II (Table 7).

Three Giant Manta Rays were reported in logbooks for Vixen II which could not be verified by EM. Instead, EM revealed these reports were likely of 3 Spotted Eagle Rays (*Aetobatus ocellatus*) that were misidentified. Spotted Eagle Rays are not currently classified as ETPs for the GoCIFFF and do not need to be reported in the threatened, endangered, and protected species logbook.

Interactions with Longhorned Pygmy Devil Rays were identified by EM during the review period, for which none were reported in logbooks (Figure 5), either as Longhorned Pygmy Devil Rays or Kuhl’s Devil Ray (Table 5). A total of 10 interactions occurred: 9 with Felix the Cat and 1 with the Enterprise (Table 5).

Table 5. Counts for Endangered, Threatened and Protected species (ETPs) recorded in Fishery Logbooks and Electronic Monitoring data, and difference in counts. Values in green indicate higher counts recorded in EM data and Values in red indicate higher counts in Fishery Logbook data.

Vessel	Species	Scientific Name	Total Interactions		
			Logbook	Electronic Monitoring	Difference
<b>Felix the Cat</b>	Hawksbill Turtle	<i>Eretmochelys imbricata</i>	2	2	0
	Narrow Sawfish	<i>Anoxypristis cuspidata</i>	5	5	0
	Longhorned Pygmy Devil Ray	<i>Mobula eregoodoo</i>	0	9	9
	<b>Total</b>		<b>7</b>	<b>16</b>	<b>9</b>
<b>Enterprise</b>	Narrow Sawfish	<i>Anoxypristis cuspidata</i>	7	9	2
	Longhorned Pygmy Devil Ray	<i>Mobula eregoodoo</i>	0	1	1
	<b>Total</b>		<b>7</b>	<b>10</b>	<b>3</b>
<b>Vixen II</b>	Giant Manta Ray	<i>Mobula birostris</i>	3	0	-3
	Narrow Sawfish	<i>Anoxypristis cuspidata</i>	2	4	2
	<b>Total</b>		<b>5</b>	<b>4</b>	<b>-1</b>
<b>Total</b>	Hawksbill Turtle	<i>Eretmochelys imbricata</i>	2	2	0
	Giant Manta Ray	<i>Mobula birostris</i>	3	0	-3
	Narrow Sawfish	<i>Anoxypristis cuspidata</i>	14	18	4
	Longhorned Pygmy Devil Ray	<i>Mobula eregoodoo</i>	0	10	10
	<b>Total</b>		<b>19</b>	<b>30</b>	<b>11</b>

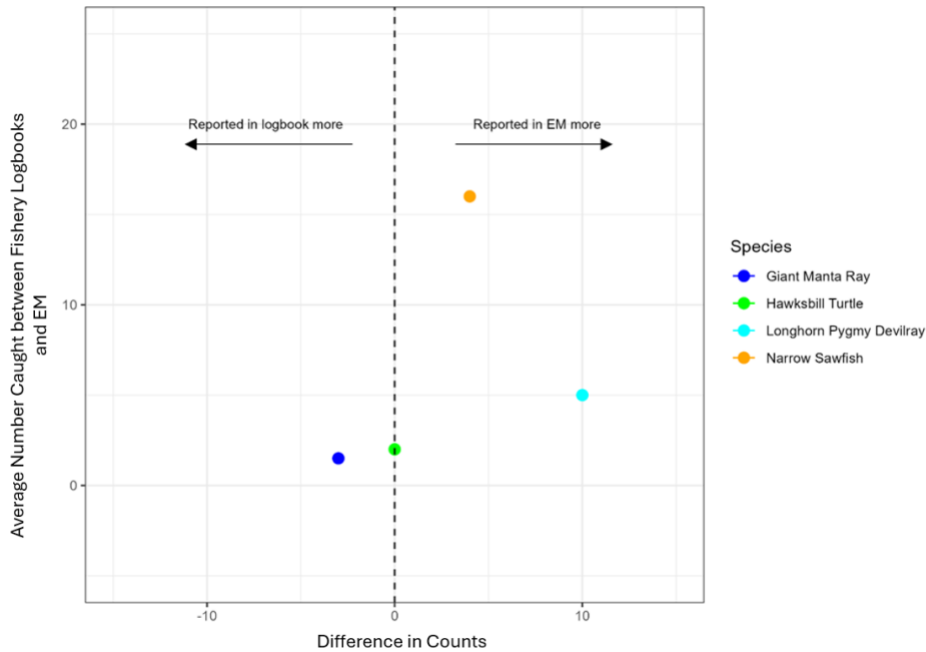


Figure 5. Total differences in counts between EM and Fishery Logbooks relative to the average number of interactions for Endangered, Threatened and Protected (ETP) species across the Wren Fishing fleet for the period reviewed.

### ETP Species Fate

For the two validated Hawksbill Turtle interactions, both were reported as released alive in logbooks and by EM (Table 6). Of the 14 interactions with Narrow Sawfish reported in logbooks, 13 were reported as released alive; however, for the 18 identified by EM, only 6 were recorded as released alive, with 10 recorded as released dead, and 2 released in unknown condition (Table 6). Of the 10 interactions recorded by EM for Longhorned Pygmy Devil Rays, 6 were recorded as released alive, 2 as released dead, and 2 with fate unknown (Table 6). Given the limitations in determining fate from EM footage, the higher rate of "released dead" outcomes observed for Sawfish and Longhorned Pygmy Devil Rays in the EM data should be considered with caution.

#### 3.2.3.2. All ETP interactions

ETP interactions were reported in 58 of the total 267 daily shots captured in logbooks for the reporting period across the fleet. For daily shots where ETP interactions were reported, there was an average of 2.89 ( $\pm 0.8$  SE) interactions. At the vessel level, the average was highest for Felix the Cat ( $4.88 \pm 1.6$  interactions), followed by Enterprise ( $1.5 \pm 0.2$ ), and Vixen II ( $1.1 \pm 0.1$ ).

A total of 171 ETP interactions were reported across all Fishery Logbooks, the vast majority of which occurred with Narrow Sawfish (90%; Table 7). Reported interactions with dolphins and Mobulid rays each accounted for 4.5% of all ETP interactions (Table 7), while there were only two reported interactions with Dwarf Sawfish and 3 interactions with Hawksbill Turtles (Table 7). Note, 3 Giant Manta Rays reported for Vixen II were identified as Spotted Eagle

Rays through EM (see Section 3.2.3.1). ETPs were predominantly reported as released alive (Table 7).

Table 6. Counts for different fate outcomes of Endangered, Threatened and Protected species (ETPs) recorded in Fishery Logbooks and Electronic Monitoring (EM) data, and difference in counts (diff). Values in green indicate higher counts recorded in EM data and Values in red indicate higher counts in Fishery Logbook data.

Vessel	Species	Release alive			Release Dead			Fate unknown			Total Interactions		
		Logbook	EM	Diff	Logbook	EM	Diff	Logbook	EM	Diff	Logbook	EM	Diff
<b>Felix the Cat</b>	Hawksbill Turtle	2	2	0	0	0	0	0	0	0	2	2	0
	Narrow Sawfish	5	2	-3	0	3	3	0	0	0	5	5	0
	Longhorned Pygmy Devil Ray	0	6	6	0	2	2	0	1	1	0	9	9
	<b>Total</b>	<b>7</b>	<b>10</b>	<b>3</b>	<b>0</b>	<b>5</b>	<b>5</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>7</b>	<b>16</b>	<b>9</b>
<b>Enterprise</b>	Narrow Sawfish	7	2	-5	0	6	6	0	1	1	7	9	2
	Longhorned Pygmy Devil Ray	0	0	0	0	0	0	0	1	1	0	1	1
	<b>Total</b>	<b>7</b>	<b>2</b>	<b>-5</b>	<b>0</b>	<b>6</b>	<b>6</b>	<b>0</b>	<b>2</b>	<b>2</b>	<b>7</b>	<b>10</b>	<b>3</b>
<b>Vixen II</b>	Giant Manta Ray	3	0	-3	0	0	0	0	0	0	3	0	-3
	Narrow Sawfish	1	2	1	1	1	0	0	1	1	2	4	2
	<b>Total</b>	<b>4</b>	<b>2</b>	<b>-2</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>4</b>	<b>-1</b>
<b>Total</b>	Hawksbill Turtle	2	2	0	0	0	0	0	0	0	2	2	0
	Giant Manta Ray	3	0	-3	0	0	0	0	0	0	3	0	-3
	Narrow Sawfish	13	6	-7	1	10	9	0	2	2	14	18	4
	Longhorned Pygmy Devil Ray	0	6	6	0	2	2	0	2	2	0	10	10
	<b>Total</b>	<b>18</b>	<b>14</b>	<b>-4</b>	<b>1</b>	<b>12</b>	<b>11</b>	<b>0</b>	<b>4</b>	<b>4</b>	<b>19</b>	<b>30</b>	<b>11</b>

Table 7. Total endangered, threatened and protected (ETP) species interactions reported by fishers for all Fishery Logbooks for the reporting period. Number alive includes injured and uninjured. \* 3 Giant Manta Rays were identified as Spotted Eagle Rays (*Aetobatus ocellatus*) in EM review, which are not considered an ETP species.

Vessel	Species	Scientific Name	Number Alive	Number Dead	Total Interactions	Proportion of total
<b>Felix the Cat</b>	Bottlenose Dolphin	<i>Tursiops</i> spp.	0	1	1	0.8%
	Hawksbill Turtle	<i>Eretmochelys imbricata</i>	3	0	3	2.4%
	Narrow Sawfish	<i>Anoxypristis cuspidata</i>	108	14	122	96.8%
	<b>Total</b>		<b>111</b>	<b>15</b>	<b>126</b>	<b>100%</b>
<b>Enterprise</b>	Australian Humpback Dolphin	<i>Sousa sahalensis</i>	0	1	1	3.7%
	Dolphins - undifferentiated	Odontocetes	0	1	1	3.7%
	Dwarf Sawfish	<i>Pristis clavata</i>	2	0	2	7.4%
	Narrow Sawfish	<i>Anoxypristis cuspidata</i>	20	3	23	85.2%
	<b>Total</b>		<b>22</b>	<b>5</b>	<b>27</b>	<b>100%</b>
<b>Vixen II</b>	Bottlenose Dolphin	<i>Tursiops</i> spp.	0	3	3	16.7%
	Giant Manta Ray	<i>Mobula birostris</i>	5	0	5	27.8%
	Kuhls Devil Ray	<i>Mobula kuhli</i>	1	0	1	5.6%
	Narrow Sawfish	<i>Anoxypristis cuspidata</i>	8	1	9	50%
<b>Total</b>		<b>15</b>	<b>4</b>	<b>18</b>	<b>100%</b>	
<b>Total</b>	Australian Humpback Dolphin	<i>Sousa sahalensis</i>	0	1	1	0.6%
	Bottlenose Dolphin	<i>Tursiops</i> spp.	0	4	4	2.3%
	Dolphins - undifferentiated	Odontocetes	0	1	1	0.6%
	<i>Dolphins grouped</i>	Odontocetes	0	6	6	3.5%
	Dwarf Sawfish	<i>Pristis clavata</i>	2	0	2	1.2%
	Narrow Sawfish	<i>Anoxypristis cuspidata</i>	136	18	154	90.1%
	<i>Sawfish Grouped</i>	Pristidae	138	18	156	91.2%
	Giant Manta Ray*	<i>Mobula birostris</i>	5	0	5	2.9%
	Kuhl's Devil Ray	<i>Mobula kuhli</i>	1	0	1	0.6%
	<i>Mobula Rays Grouped</i>	<i>Mobula</i> spp.	6	0	6	3.5%
	Hawksbill Turtle	<i>Eretmochelys imbricata</i>	3	0	3	1.8%
	<b>Total</b>		<b>147</b>	<b>24</b>	<b>171</b>	<b>100%</b>

Interactions with ETP species were observed at various locations across the Wren Fishing fleet throughout the reviewed period (Figure 6a). Narrow Sawfish interactions occurred across fishing locations (Figure 6b), while interactions with Mobulid Rays (Giant Manta, Kuhl's Devil Ray, and Longhorn Pygmy Devil Rays) were documented exclusively south of 14.1°S. Interactions with Hawksbill Turtles were recorded at 14°S, while interactions with dolphins were typically recorded at lower latitudes, between 15°S and 16°S. Hotspot analysis indicated that ETP interactions occurred in three main areas closely aligned with concentrated fishing efforts during the reporting period. The highest density occurred just south of 14°S, followed by a hotspot around 15°S and a hotspot around 12°S. It should be noted that all logbook reports of Giant Manta Rays are included here, despite 3 reported by Vixen II being identified as Spotted Eagle Rays through EM (see Section 3.2.3.1). Likewise, Longhorned Pygmy Devil Rays identified by EM are included here, despite not being reported in logbooks.

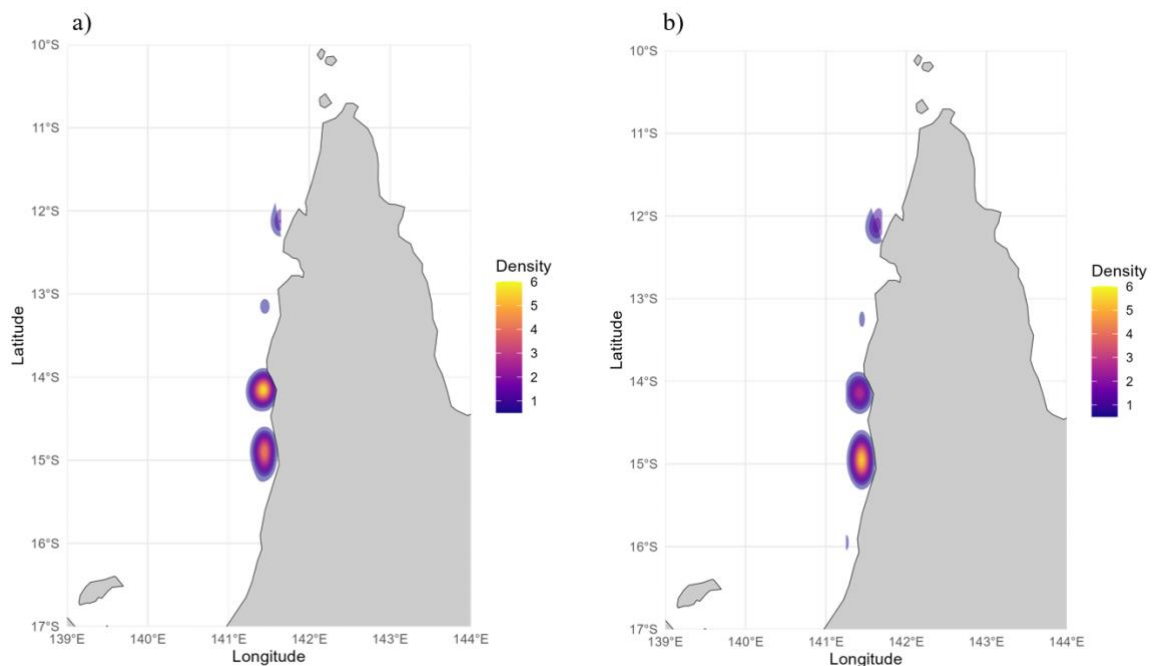


Figure 6. Heat map of a) endangered, threatened and protected species interaction density, and b) Narrow Sawfish (*Anoxypristis cuspidata*) for reported interactions across the Wren Fishing fleet for the period reviewed.

### 3.2.2. Discards

#### 3.2.2.1. Logbook Validation

Discards of Hammerhead Sharks were reported in relatively low numbers with moderate agreement between logbooks and EM overall (Figure 7) and for each vessel (Table 8). Discards for Great Hammerheads was generally higher in logbooks with a mean difference of -3 ( $\pm$  6.8) individuals (Figure 7), but this was predominantly driven by daily shots for the Enterprise with a mean difference of -9.5 ( $\pm$  31.8) individuals (Table 8), suggesting potential over-reporting of discards for this species by this vessel. Similarly, discards of Winghead Sharks were higher in logbooks for the Enterprise than in EM, with a mean difference of -4.5 ( $\pm$  6.4) individuals, suggesting some potential over-reporting for this species. Winghead Shark discards were also

reported in higher numbers in logbooks for Felix the Cat, but the discrepancy was low (-25%). In contrast, discards of Scalloped Hammerheads was higher in EM across the fleet, with a mean difference of 4.12 ( $\pm 8.2$ ) individuals (Figure 7), which was consistent across vessels (Table 8).

Discards in the other shark and ray category were higher in EM compared with logbooks overall, with high mean difference suggesting overall low congruence (Table 8; Figure 7), and under-reporting of discards of other shark and ray species in logbooks. However, the mean difference and large confidence intervals across the fleet indicated that reporting under this category is inconsistent and assessment of congruence is unreliable.

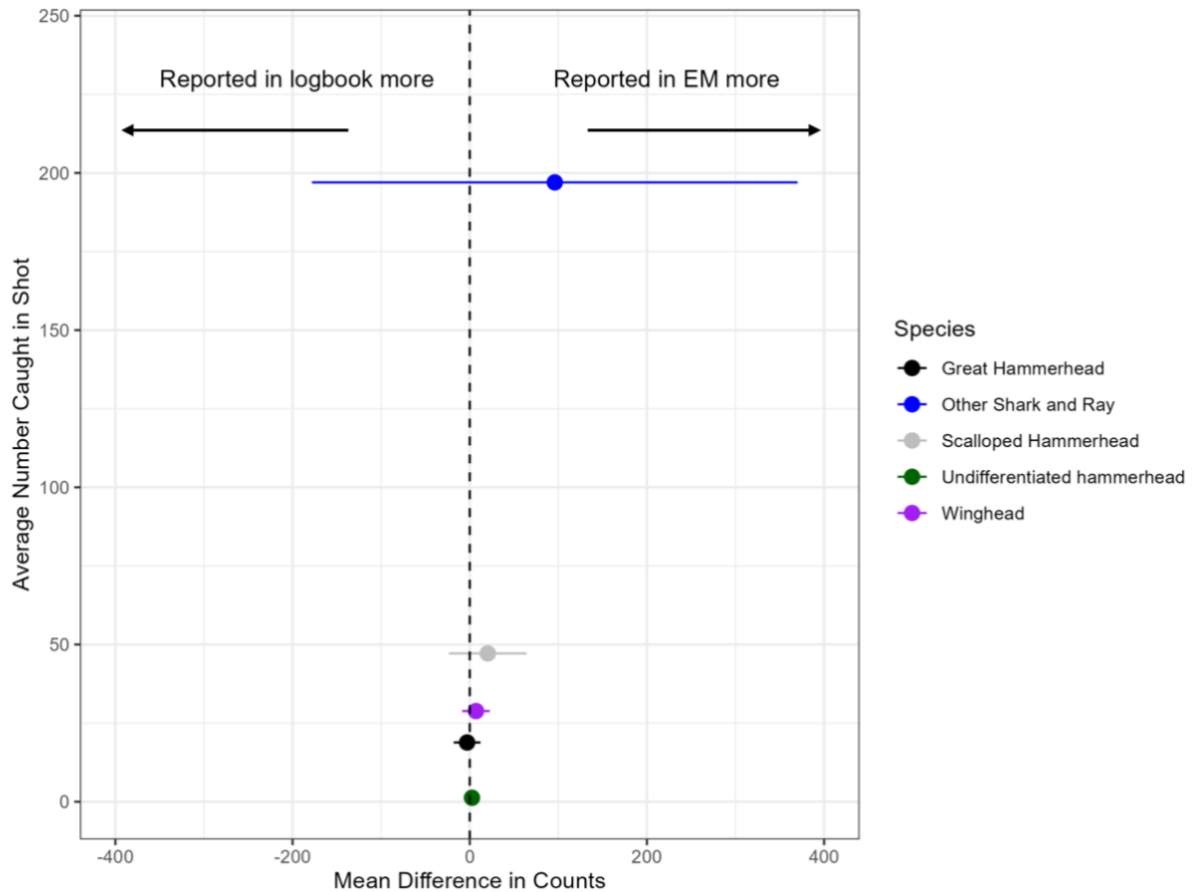


Figure 7. Mean differences in counts ( $\pm 95\%$  confidence interval) between Electronic Monitoring and Fishery Logbooks relative to the average catch of discarded catch across the Wren Fishing fleet for the period reviewed.

Table 8. Comparison of recorded discards between Electronic Monitoring and Fishery Logbooks for each vessel across the Wren Fishing fleet for the period reviewed.

Vessel	Species	Scientific Name	Mean difference in counts	Average number reported ( $\pm$ SE)			Mean difference in counts as proportion of average catch
			( $\pm$ 95% CI)	EM	Fishery Logbooks	All	
<b>Felix the Cat</b>	Great Hammerhead	<i>Sphyrna mokarran</i>	0 ( $\pm$ 14.9)	8.7 ( $\pm$ 3.8)	8.7 ( $\pm$ 5.4)	8.7 ( $\pm$ 4.2)	10%
	Scalloped Hammerhead	<i>Sphyrna lewini</i>	8.25 ( $\pm$ 15.9)	18.75 ( $\pm$ 9.6)	10.5 ( $\pm$ 5.5)	14.6 ( $\pm$ 7.6)	92%
	Winghead	<i>Eusphyra blochii</i>	0.5 ( $\pm$ 3.3)	25.5 ( $\pm$ 19.5)	30 ( $\pm$ 19)	3 ( $\pm$ 1.8)	-25%
	Hammerhead undifferentiated	Family <i>Sphyrnidae</i>	1	1	0	0.5	200%
	<i>Hammerhead Group</i>	Family <i>Sphyrnidae</i>	9 ( $\pm$ 24.5)	28.8 ( $\pm$ 14.5)	19.8 ( $\pm$ 10.2)	24.2 ( $\pm$ 24.3)	50%
	Other Shark and Ray	Subcalss Elasmobranchii	-6.25 ( $\pm$ 230.2)	71.75 ( $\pm$ 38.9)	78 ( $\pm$ 49.8)	74.9 ( $\pm$ 41.4)	-29%
<b>Enter- prise</b>	Great Hammerhead	<i>Sphyrna mokarran</i>	-9.5 ( $\pm$ 31.8)	4 ( $\pm$ 2)	13.5 ( $\pm$ 0.5)	8.8 ( $\pm$ 4.1)	-112%
	Scalloped Hammerhead	<i>Sphyrna lewini</i>	-1.5 ( $\pm$ 82.6)	22.5 ( $\pm$ 0.5)	24 ( $\pm$ 6)	23.3 ( $\pm$ 3.5)	4%
	Winghead	<i>Eusphyra blochii</i>	-4.5 ( $\pm$ 6.4)	25.5 ( $\pm$ 19.5)	30 ( $\pm$ 19)	27.8 ( $\pm$ 15.8)	-34%
	Hammerhead undifferentiated	Family <i>Sphyrnidae</i>	1	1	0	0.5	200%
	<i>Hammerhead Group</i>	Family <i>Sphyrnidae</i>	- 14.5 ( $\pm$ 57.2)	53.0 ( $\pm$ 18)	67.5 ( $\pm$ 13.5)	60.2 ( $\pm$ 14.2)	-28%
	Other Shark and Ray	Subcalss Elasmobranchii	95.5 ( $\pm$ 514.6)	113.5 ( $\pm$ 22.5)	18 ( $\pm$ 18)	65.8 ( $\pm$ 42.4)	144%
<b>Vixen II</b>	Great Hammerhead	<i>Sphyrna mokarran</i>	1	8	7	7.5	13%
	Scalloped Hammerhead	<i>Sphyrna lewini</i>	1.5 ( $\pm$ 108.0)	16 ( $\pm$ 6)	14.5 ( $\pm$ 14.5)	15.3 ( $\pm$ 9.1)	87%
	Winghead	<i>Eusphyra blochii</i>	1.5 ( $\pm$ 31.8)	4	2.5 ( $\pm$ 2.5)	3.3 ( $\pm$ 1.6)	89%
	<i>Hammerhead Group</i>	Family <i>Sphyrnidae</i>	3.5 ( $\pm$ 133.4)	24.0 ( $\pm$ 10.0)	20.5 ( $\pm$ 20.5)	22.3 ( $\pm$ 13.2)	91%
	Other Shark and Ray	Subcalss Elasmobranchii	61 ( $\pm$ 88.9)	110.5 ( $\pm$ 34.5)	49.5 ( $\pm$ 27.5)	80 ( $\pm$ 35.6)	86%
<b>Total</b>	Great Hammerhead	<i>Sphyrna mokarran</i>	-3 ( $\pm$ 6.8)	7 ( $\pm$ 2.0)	10 ( $\pm$ 2.7)	8.5 ( $\pm$ 2.35)	-30%
	Scalloped Hammerhead	<i>Sphyrna lewini</i>	4.12 ( $\pm$ 8.2)	19 ( $\pm$ 4.7)	14.9 ( $\pm$ 4.4)	16.9 ( $\pm$ 4.46)	66%
	Winghead	<i>Eusphyra blochii</i>	-0.5 ( $\pm$ 2.64)	9 ( $\pm$ 5.3)	9.5 ( $\pm$ 5.8)	9.25 ( $\pm$ 9.25)	-2%
	Hammerhead undifferentiated	Family <i>Sphyrnidae</i>	1	1	0	0.5 ( $\pm$ 0.3)	200%
	<i>Hammerhead Group</i>	Family <i>Sphyrnidae</i>	1.8 ( $\pm$ 13.1)	33.6 ( $\pm$ 8.9)	31.9 ( $\pm$ 10.2)	32.8 ( $\pm$ 9.2)	41%
	Other Shark and Ray	Subcalss <i>Elasmobranchii</i>	36 ( $\pm$ 90.3)	91.9 ( $\pm$ 21.0)	55.9 ( $\pm$ 25.7)	73.9 ( $\pm$ 23.6)	43%

\*Undifferentiated groups are animals which could not be confirmed to species level in electronic monitoring review only.

### 3.2.2.2. Discards from Electronic Monitoring

Review of EM footage identified 2,749 individual discarded animals across the fleet, not including ETP species (Table 9), which amounted to approximately 20.7% of the total catch recorded by EM for the reporting period. Hammerhead Sharks accounted for 9.2% of total discards, while ‘other sharks and rays’ made up 47.2%, with similar proportions across vessels (Table 9). Other shark and ray discards predominantly consisted of Blacktip Whalers, Milk Sharks (*Rhizopriondon acutus*), Blacktip Reef Sharks (*Carcharhinus melanopterus*) and Fossil Sharks (*Hemipristis elongata*), Spotted Eagle Rays (*Aetobatus ocellatus*), Australian Cownose Rays (*Rhinoptera neglecta*), and Wedgefish species (*Rhynchobatus* spp.).

Table 9. Discards recorded by Electronic Monitoring across the Wren Fishing fleet for the reporting period. Note: These discards do not include Endangered, Threatened and Protected species.

Vessel	Species Group	Total no.	No. as proportion of total discards
<b>Felix the Cat</b>	Hammerhead	110	9.3%
	Other Shark and Ray	521	43.9%
	Mackerel sp.	93	7.8%
	Other teleost fish	458	38.6%
	Unknown	4	0.3%
	<b>Total</b>	<b>1186</b>	<b>100%</b>
<b>Enterprise</b>	Hammerhead	98	12.4%
	Other Shark and Ray	406	51.5%
	Mackerel sp.	29	3.7%
	Other teleost fish	252	31.9%
	Unknown	4	0.5%
	<b>Total</b>	<b>789</b>	<b>100%</b>
<b>Vixen II</b>	Hammerhead	46	5.9%
	Other Shark and Ray	371	47.9%
	Mackerel sp.	207	26.7%
	Other teleost fish	150	19.4%
	Unknown	0	0%
	<b>Total</b>	<b>774</b>	<b>100%</b>
<b>Total</b>	Hammerhead	254	9.2%
	Other Shark and Ray	1298	47.2%
	<i>Total shark and ray discards</i>	<i>1552</i>	<i>56.5%</i>
	Mackerel sp.	329	12%
	Other teleost fish	860	31.3%
	<i>Total teleost discards</i>	<i>1189</i>	<i>43.3%</i>
	Unknown	8	0.3%
	<b>Total</b>	<b>2749</b>	<b>100%</b>

Teleost fish accounted for 43.3% of total discards recorded by EM. Within this group, Mackerels (*Scomberomorus* spp.) amounted to 12% of total discards and consisted entirely of depredated or undersized individuals. Mackerel discards made up a higher proportion of discards for Vixen II (26.7%) than the other two vessels (7.8% and 3.7%), with the majority being depredated. Other teleosts accounted for 31.3% of total discards, and consisted predominantly of Queenfish, Pomfret, Catfish, Tuna, and Threadfin. ‘Unknown’ animals accounted for <1% of total discards identified by EM.

Of note, shark and ray catches were often taken out of the view of the EM system, making determination of fate (discarded or not) impossible for EM observers, and likely contributing to discrepancies between logbooks and EM. This was particularly common on the Enterprise,

where animals were taken behind the centre console and obscured from view of the cameras. The fate for these animals was therefore recorded as “unknown” and therefore not considered in reported discards.

## 4. Summary and Recommendations

The aim of this report was to conduct an independent validation of mandatory Fishery Logbooks using EM for the operations of Wren Fishing Pty Ltd for (i) retained species, (ii) Endangered, Threatened, or Protected (ETP) species interactions, and (iii) discards. This report compares EM and Fishery Logbook reporting of catch numbers for these groups for the period of 12/04/2024 to 07/10/2024, as part of the 2024-2025 fishing season in the Gulf of Carpentaria Inshore Finfish Fishery (GoCIFFF; FIP Unit of Assessment 1). At a high level, the overall congruence was:

- Good for the primary target of Grey Mackerel, and moderate for retained teleost fishes, but low for retained sharks
- Reasonable for ETP interactions, with some issues in species identification and confirmation of fate
- Moderate for discarded Hammerhead Sharks, but inconsistent for other sharks and rays.

The following section summarises the main findings of the validation process.

### 4.1. Key Findings

Of the 267 fishing shots conducted during the review period, 26 shots (9.74%) were reviewed and validated using EM. While the threshold for review was 10% of shots per vessel per trip, camera malfunctions during one trip for Felix the Cat, resulted in one shot being available for review from this trip.

Retained catches consisted primarily of Grey Mackerel, followed by Blacktip Whalers. Congruence between logbooks and EM data was good for Grey Mackerel, with low mean differences in recorded catch. Congruence for other retained teleost fishes was varied. Species such as Pomfret and Giant Queenfish, were consistently reported in higher numbers by EM, suggesting underreporting of these species in Fishery Logbooks. Other teleost showed low mean differences, but high proportional discrepancies driven by their low overall catch numbers, suggesting occasional underreporting in Fishery Logbooks for these less frequently caught species.

There was lower congruence between Fishery Logbooks and EM for retained sharks and rays. Blacktip Whalers were recorded in much higher numbers by EM, indicating underreporting in Fishery Logbooks. This was the case for most retained sharks, with the exception of Pigeye and Bull Sharks and Blacktip Reef Sharks, which reported in higher numbers in Fishery Logbooks than by EM, indicating potential overreporting. In assessing reported catches at the vessel level, it is apparent that catches of a number of Whaler Sharks (*Carcharhinus* spp.: Hardnose Sharks, Blacktip Reef Sharks, Spinner Sharks, and Creek Whalers) and other sharks (Milk, Fossil, and Weasel Sharks) go largely unreported in Fishery Logbooks across all 3 vessels.

For Spanish Mackerel, which require additional monitoring, under the Queensland Harvest Strategy, catches were relatively low but reported in almost 70% of all Fishery Logbooks for the report period, with the highest average catches reported by Vixen II. This species caught in the highest density around 15°S, which was associated with higher fishing effort overall.

Fishery Logbooks showed reasonable congruence with EM for ETP species, though some discrepancies were found. Interactions involved 4 species: Hawksbill Turtle, Narrow Sawfish, Giant Manta Ray, and Longhorned Pygmy Devil Ray. For Hawksbill Turtles, both Fishery Logbooks and EM reported the same number of interactions, with both instances recorded as released alive. Narrow Sawfish had the highest number of interactions, with 14 reported in logbooks compared to 18 in EM, driven by 2 individuals not being reported on two vessels. Further, logbooks reported 13 of 14 released alive, while EM showed only 6, with 10 released dead (2 fate unknown). Three Giant Manta Ray interactions reported in Fishery Logbooks were identified by EM as Spotted Eagle Rays, which are not classified as ETPs. Such misidentifications can erroneously inflate ETP interactions for a fishery and have implications for guiding management of fishing operations. In addition, Longhorned Pygmy Devil Rays, which are considered alongside Kuhl's Devil Rays here due to taxonomic uncertainty, were not reported in Fishery Logbooks, but 10 interactions were identified by EM. Such under-reporting can have similar implications for management decisions surrounding fishery interactions with ETPs. While there is general agreement between Fishery Logbook and EM data, discrepancies in species identification, particularly for ray species. Fate reporting, particularly for Sawfish and Devil Rays, warrant further attention. However, challenges in determining fate from EM footage may be a driver of higher numbers of individuals recorded as released dead by EM observers, particularly for individuals that have undergone long interactions. Therefore, discrepancies in fate should be considered with caution.

Interactions with ETP species were concentrated in three key hotspots, although interactions occurred across most fishing locations. Sawfish interactions were widespread, while interactions with Mobulid rays were recorded exclusively south of 14.1°S, and dolphin interactions were more frequent at lower latitudes (15°S - 16°S).

Discards of Hammerhead Sharks showed moderate agreement between Fishery Logbooks and EM, with relatively low numbers overall. For Great Hammerheads, discards were generally higher in logbooks, particularly for the Enterprise vessel, suggesting potential over-reporting by this vessel. Winghead Shark discards were also higher in Fishery Logbooks for the Enterprise, indicating possible over-reporting. In contrast, Felix the Cat reported lower discards of Winghead in logbooks compared to EM, suggesting potential underreporting for this species. In contrast, Scalloped Hammerhead discards were higher in EM overall, with consistent differences across vessels, suggesting potential underreporting in logbooks for this species. For other sharks and rays, discards were higher in EM and highly variable, indicating under-reporting in logbooks. The high variability in the data suggests inconsistent reporting in this category, making congruence assessment unreliable, and efforts to improve reporting against this category are warranted.

A total of 2,749 individual discarded animals were identified across the fleet from EM footage, representing around 20% of the total catch. Hammerhead Sharks (combined) accounted for 9.2% of total discards identified, while 'Other sharks and rays' made up 47.2%, with Blacktip Whalers, Milk Sharks, Blacktip Reef Sharks, Fossil Sharks, Spotted Eagle Rays, Australian Cownose Rays, and Wedgefish being the main species discarded. Teleost fish made up 43.3% of total discards, with Mackerels comprising 12% and consisting of primarily depredated or undersized individuals, and a higher proportion discarded by Vixen II. Other teleost discards made up just over 30% of total discards, and included Queenfish, Pomfret, Catfish, Tuna, and Threadfin. 'Unknown' animals accounted for less than 1% of total discards.

## 4.2. Recommendations

The findings of this report highlight two key areas where improvements in reporting can be made: (1) species with lower agreement likely due to unreported catches or interactions, misidentification, or misreporting in logbooks by fishers; and (2) species with lower agreement potentially driven by limitations in current EM systems. The following recommendations are based on these findings and are intended to support improvements in data accuracy and monitoring effectiveness across fishing operations.

### Retained species:

- **Improve reporting of less-frequently retained teleosts:** Catches of less-frequently caught species such as Pomfret, Giant Queenfish, and Threadfins, were consistently under-reported in Fishery Logbooks. A driver of these discrepancies was unreported catches in logbooks. Improved reporting for all retained species will lead to better congruence between Fishery Logbooks and EM data and ultimately enhance the validity of catch composition data and reliability of logbook records.
- **Improve reporting for retained sharks and rays:** Retained catches for most sharks and rays were consistently underreported in logbooks, including for the primary target of Blacktip Whalers, and Whaler Sharks more broadly. With Whaler Sharks making up the majority of shark and ray catches, improved reporting of retained catches for these species is crucial to improve congruence between the datasets. Further, sharks are often subject to management measures and trade restrictions. Consistent reporting is important for evidence-based management and helps safeguard the long-term viability of the fishery.
- **Strengthen Identification Skills for Fishers and EM Observers:** Some inconsistencies between reported numbers were driven by misidentification by fishers or challenges in identifying some animals to species level or EM observers. Training of fishers and EM observers is important to ensure accurate species identification and support accurate reporting. Further, enhancing EM observer skill and accuracy improves confidence in EM as a verification tool and helps pinpoint the source of discrepancies more clearly (i.e., fisher vs observer error).

## **Endangered, Threatened and Protected Species:**

- **Improve identification skills for batoid species (rays and devil rays) by fishers:** Inconsistencies were found for reported interactions with a number of ray species. Specifically, EM determined that some Spotted Eagle Rays (not an ETP) had been misidentified as Giant Manta Rays, while a number of Longhorned Devil Rays (considered synonymous with Kuhl's Devil Rays) had not been reported in Fishery Logbooks. Accurate identification is essential to meet reporting obligations for protected species, inform risk assessments, and avoid triggering unnecessary management action or overlooking real concerns.
- **Improve Accuracy in Reporting the Fate of ETP Species:** Logbooks often recorded ETPs as released alive, while EM observed higher rates of mortality. Understanding actual mortality rates is critical for evaluating fishery impacts on vulnerable species. While, it cannot be reliably confirmed whether these differences are true or due to challenges with determining fate reliably from EM, improved accuracy in reporting the fate of ETPs by both fishers and EM observers is critical. Fishers should confirm release condition of ETPs by assessing behavioural indicators upon release such as active swimming, and report these accurately in Fishery Logbook, while EM observers should improve understanding of all possible indicators of life for ETPs identifiable from EM footage to determine fate.

## **Discards:**

- **Improve reporting of Hammerhead Shark Discards in Fishery Logbooks:** Moderate discrepancies were noted between Fishery Logbooks and EM data for all Hammerhead Shark species (positive and negative) across all vessels, warranting improved reporting of discards for these species. Given Hammerhead Sharks are a regulated, no-take species in Queensland, accurate discard data is essential for compliance monitoring and assessment of fishery impacts.
- **Improve species-level reporting of 'Other sharks and ray' discards:** Reported discards under the 'Other shark and ray' category were highly variable across all vessels. By grouping diverse species under generic categories reduces data value. The most recent version of the Queensland Shark and Ray Fishery Logbook (not available for the review period) allows fishers to report shark and ray discards to the species level (Logbook SR04 – Version 1; see Appendix 1). It is recommended that these logbooks are used moving forward to improve discard tracking and inform bycatch mitigation.
- **Modification to placement of discards onboard vessels to confirm fate:** On all vessels, the fate of several individuals could not be conclusively determined as they were taken off camera. This was particularly prevalent on Enterprise, where shark species, including Hammerhead Sharks, were moved behind the centre console, an area not covered by cameras. Discard visibility is essential for validating logbook entries and assessing discard handling. Ensuring discards occur in camera-visible areas strengthens confidence in EM data.

## 5. References

- AUSTRALIAN FISHERIES MANAGEMENT AUTHORITY. 2024. *Electronic monitoring program* [Online]. [Accessed].
- JACOBSEN, I., WALTON, L. & LAWSON, A. 2021. Gulf of Carpentaria Inshore Fishery Level 2 Ecological Risk Assessment [Species of Conservation Concern]. Brisbane: State of Queensland.

## 6. Appendix

### Appendix 1. Queensland Fishery Logbooks used by Wren Fishing Pty Ltd

#### Gulf of Carpentaria Net Fisheries Logbook

Gulf of Carpentaria net fisheries logbook											G806 (version 01)	
Boat Name		Boat Mark		Commercial Fisher's Name (printed)			Commercial Fisher's Licence No.		Logbook No.		Page No.	
Boat Activity Codes: 0...Fishing 1...Searching 2...Steaming 3...Not fishing				No fishing operation was conducted on (insert relevant date's): _____ TO _____								
<b>EFFORT</b>												
Date		_____ / _____ / _____		_____ / _____ / _____		_____ / _____ / _____		_____ / _____ / _____		_____ / _____ / _____		
Boat activity code												
Fishery symbol used (circle)		N3 N11 N12 N13		N3 N11 N12 N13		N3 N11 N12 N13		N3 N11 N12 N13		N3 N11 N12 N13		
Prior/transhipment/emergency notice number												
Location	Latitude (or Grid)											
	Longitude (or Site)											
Mesh size (mm)												
Total net's length (m)												
Mesh drop (No. of mesh)												
Dropper length (m)												
Water depth (m)												
<b>RETAINED CATCH</b>												
Species	Form	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	
Barramundi	F											
	W											
King threadfin	F											
	W											
Grey mackerel	F											
	W											
Spanish mackerel	F											
	W											
Jewfish	F											
	W											
Black jewfish	W											
Cobia	F											
Barred javelin	F											
.....												
.....												
.....												
.....												
Species	Form	Number (containers)	Weight (kg)	Number (containers)	Weight (kg)	Number (containers)	Weight (kg)	Number (containers)	Weight (kg)	Number (containers)	Weight (kg)	
Blue threadfin	F											
	W											
Giant queenfish	F											
	W											
.....												
.....												
Did you have an interaction with a TEP animal?		Yes / No		Yes / No		Yes / No		Yes / No		Yes / No		
Comments						I certify that the information I have provided on this form is a complete and accurate record.						
						Commercial fishers signature..... Date .....						

# Queensland Shark and Ray Fishery Logbook\*

Queensland shark and ray fishery logbook														SR04 (version 1)			
Boat Mark		Commercial Fisher's Name (printed)				Commercial Fisher's Licence No.				Logbook No.		Page No.					
EFFORT																	
Date		...../...../.....		...../...../.....		...../...../.....		...../...../.....		...../...../.....		...../...../.....		...../...../.....			
Prior/emergency notice number																	
Location	Latitude (or Grid)																
	Longitude (or Site)																
Fishing Method (L = Line or N = Net or MH = Multi-hook)																	
CATCH																	
Species	Form	Retained		Discarded		Retained		Discarded		Retained		Discarded		Retained		Discarded	
		Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)	Number (individuals)	Weight (kg)
<b>Blacktip whalers</b> <i>(Carchin, C. limbatus)</i>		T															
<b>Creek whaler</b> <i>(C. fitzroyensis)</i>		T															
<b>Dusky whaler</b> <i>(C. obscurus)</i>		T															
<b>Fossil &amp; weasel sharks</b> <i>(H. longus, H. australensis)</i>		T															
<b>Graceful shark</b> <i>(C. amblyrhynchoides)</i>		T															
<b>Lemon shark</b> <i>(N. lewini)</i>		T															
<b>Milk, sharpnose &amp; hardnose sharks</b> <i>(R. acutus, R. taylori, C. macdon)</i>		T															
<b>Pigeon &amp; bull sharks</b> <i>(C. leucas, C. bombonensis)</i>		T															
<b>Sandbar shark</b> <i>(C. charcharias plumbeus)</i>		T															
<b>Spinner shark</b> <i>(C. brevipinna)</i>		T															
<b>Spot-tail shark</b> <i>(C. asotus)</i>		T															
<b>White cheek shark</b> <i>(C. caudus)</i>		T															
<b>Blacktip reef shark</b> <i>(C. melanopterus)</i>		T															
<b>Guitarfish</b> <i>(R. rhynchobatidae)</i>		T															
<b>Other rays</b> <i>(Aetideidae, Dasyatidae, Rhinopteridae)</i>		T															
<b>Shovelnose ray</b> <i>(Rhinobatidae)</i>		T															
.....																	
<b>Great hammerhead</b> <i>(S. lewini)</i>																	
<b>Scalloped hammerhead</b> <i>(S. lewini)</i>																	
<b>Smooth hammerhead</b> <i>(S. paucus)</i>																	
<b>Winghead</b> <i>(E. bleekeri)</i>																	
Did you have an interaction with a TEP animal?		Yes / No		Yes / No		Yes / No		Yes / No		Yes / No		Yes / No		Yes / No		Yes / No	
Comments								I certify that the information I have provided on this form is a complete and accurate record.									
Commercial fisher's signature.....								Date ...../...../.....									

\* This is the most recent Fishery Logbook version (SR04 version 1). An earlier version (SR03 Version 1) was used during the reporting period.



## Appendix 2. Validation of retained species by daily shot

Table A1. Mean difference in counts ( $\pm 95\%$  confidence interval) between EM and Fishery Logbooks, average number (from EM and Fishery Logbooks) reported caught per daily shot, mean difference in counts as a percentage of average catch for retained catch for each vessel across Wren Fishing fleet for time period reviewed.

Vessel	Species	Scientific Name	Mean difference in counts	Average number reported ( $\pm$ SE)			Mean difference in counts as proportion of average catch
			( $\pm 95\%$ CI)	EM	Fishery Logbooks	All catch	
<b>Felix the Cat</b>	<b>Teleosts</b>						
	Grey Mackerel	<i>Scomberomorus semifasciatus</i>	13.27 ( $\pm 968.3$ )	198.4 ( $\pm 82.6$ )	191.4 ( $\pm 79.5$ )	372.1 ( $\pm 182.7$ )	4%
	Spanish Mackerel	<i>Scomberomorus commerson</i>	-0.2 ( $\pm 49.71$ )	8.5 ( $\pm 3.2$ )	8.6 ( $\pm 3.8$ )	15.75 ( $\pm 6.62$ )	-1%
	Giant Queenfish	<i>Scomberoides commersonianus</i>	4 ( $\pm 76.2$ )	2 ( $\pm 0.9$ )	0.4 ( $\pm 0.4$ )	3 ( $\pm 2$ )	1%
	Cobia	<i>Rachycentron canadum</i>	1 ( $\pm 25.4$ )	0.8 ( $\pm 0.3$ )	0.3 ( $\pm 0.3$ )	1 ( $\pm 0.5$ )	1%
	Teleost undifferentiated	Class <i>Actinopterygii</i>	89	29.7 ( $\pm 22.3$ )	0	44.5	200%
	Pomfret	<i>Parastromateus niger</i>	60	10 ( $\pm 6.4$ )	0	30	200%
	Threadfin undifferentiated	Family <i>Polynemidae</i>	15	15	0	7.5	200%
	Blue Threadfin	<i>Eleutheronema tetradactylum</i>	6	3 ( $\pm 2$ )	0	3	200%
	King Threadfin	<i>Polydactylus macrochir</i>	4	4	0	2	200%
	Barred Javelin	<i>Pomadasys argenteus</i>	1	1	0	0.5	200%
	Spotty Mackerel	<i>Scomberomorus munroi</i>	1	1	0	0.5	200%
	Boofhead catfish	<i>Sciades leptaspis</i>	1	1	0	0.5	200%
	<i>Mackerels Grouped</i>	<i>Scomberomorus spp.</i>	13.3 ( $\pm 5.9$ )	387.4 ( $\pm 140.6$ )	374.6 ( $\pm 135.3$ )	380.7 ( $\pm 137.9$ )	3%
	<b>Shark</b>						
Blacktip Whalers	<i>Carcharhinus tilstoni</i> & <i>Carcharhinus limbatus</i>	11.7 ( $\pm 88.2$ )	20.3 ( $\pm 11.1$ )	13.9 ( $\pm 4.8$ )	31.3 ( $\pm 17.8$ )	37%	
Spot-tail Shark	<i>Carcharhinus sorrah</i>	5.6 ( $\pm 33.93$ )	8.7 ( $\pm 4.3$ )	5.2 ( $\pm 1.8$ )	11.1 ( $\pm 6.59$ )	50%	
Pigeye & Bull sharks	<i>Carcharhinus amboinensis</i> & <i>Carcharhinus leucas</i>	-2.75 ( $\pm 11.35$ )	1.2 ( $\pm 0.8$ )	3 ( $\pm 1.6$ )	3.12 ( $\pm 0.8$ )	-88%	
Creek Whaler	<i>Carcharhinus fitzroyensis</i>	-2.67 ( $\pm 20.1$ )	1.5 ( $\pm 1.2$ )	3.5 ( $\pm 2.4$ )	3.3 ( $\pm 0.9$ )	-80%	
Milk & Hardnose Sharks	<i>Rhizopriondon acutus</i> & <i>Carcharhinus macloti</i>	109	15.6 ( $\pm 8.5$ )	0	54.5	200%	

	Carcharhinus undifferentiated	<i>Carcharhinus</i> spp.	41	6.8 (± 2.7)	0	20.5	200%
	Spinner Shark	<i>Carcharhinus brevipinna</i>	1	1	0	1	200%
	Blacktip Reef Shark	<i>Carcharhinus melanopterus</i>	1	1	0	0.5	200%
	<i>Whaler Sharks Grouped</i>	<i>Carcharhinus</i> spp.	8.1 (±7.8)	27.3 (± 11.0)	19.1 (± 4.4)	23.2 (±7.4)	35%
<b>Enterprise</b>	<b>Teleost</b>						
	Grey Mackerel	<i>Scomberomorus semifasciatus</i>	-3.67 (± 619.1)	128.7 (± 50.7)	130 (± 53.1)	230.6 (± 106.63)	-2%
	Spanish Mackerel	<i>Somberomorus commerson</i>	-1.88 (± 18.2)	3.5 (± 1.6)	4.7 (± 2.5)	6.7 (±2.9)	-28%
	Giant Queenfish	<i>Scomberoides commersonnianus</i>	7.2 (26.3)	6.4 (± 5.2)	1.3 (± 0.6)	5.4 (±4.3)	133%
	Cobia	<i>Rachycentron canadum</i>	- 0.67 (± 6.25)	0.5 (± 0.3)	1 (± 0.7)	1 (±0.29)	-67%
	Pomfret	<i>Parastromateus niger</i>	349	49.9 (± 12.5)	0	174.5	200
	Teleost undifferentiated	Class <i>Actinopterygii</i>	175	25 (± 11.0)	0	87.5	200%
	Boofhead catfish	<i>Sciades leptaspis</i>	6	2 (± 1)	0	3	200%
	<i>Mackerels Grouped</i>	<i>Scomberomorus</i> spp.	-5.5 (± 7.6)	263.6 (± 80.2)	269.1 (± 85.6)	266.4 (± 82.9)	-2%
	<b>Shark</b>						
	Blacktip Whalers	<i>Carcharhinus tilstoni</i> & <i>Carcharhinus limbatus</i>	55 (± 170.4)	40 (± 29.0)	9.1 (± 6.3)	43.61 (± 35.0)	126%
	Creek Whaler	<i>Carcharhinus fitzroyensis</i>	1 (16.7)	3.8 (± 3.1)	3 (± 2.2)	4.1 (±2.2)	24%
	Pigeye & Bull sharks	<i>Carcharhinus amboinensis</i> & <i>Carcharhinus leucas</i>	-1 (± 9.9)	1.3 (± 0.8)	2 (± 1.0)	2.5 (± 0.7)	-40%
	Spot-tail shark	<i>Carcharhinus sorrah</i>	-3.25 (± 3.4)	0.3 (± 0.3)	3.5 (± 1.3)	1.88 (± 0.6)	-173%
	Blacktip Reef Shark	<i>Carcharhinus melanopterus</i>	-3 (±4.5)	0.3 (± 0.3)	3.3 (± 1.2)	1.8 (±0.5)	-171%
	Milk & Hardnose Sharks	<i>Rhizopriondon acutus</i> & <i>Carcharhinus macloti</i>	30	4.3 (± 2.6)	0	15	200%
	Carcharhinus undifferentiated	<i>Carcharhinus</i> spp.	12	4 (± 1.5)	0	6	200%
	Fossil & Weasel Sharks	<i>Hemipristis elongata</i> & <i>Hemipristis australiensis</i>	1	1	0	0.5	200%
	<i>Whaler Sharks Grouped</i>	<i>Carcharhinus</i> spp.	28.6 (±23.0)	42.1 (± 28.8)	13.5 (± 6.3)	27.8 (±17.4)	103%
<b>Vixen II</b>	<b>Teleost</b>						
	Grey Mackerel	<i>Scomberomorus semifasciatus</i>	-3.1 (± 302.7)	56.2 (± 31.9)	58.0 (± 33.5)	97.86 (± 47.2)	-3%
	Spanish Mackerel	<i>Somberomorus commerson</i>	-1.6 (± 17.8)	2.2 (± 1.1)	3.1 (± 2.2)	4.8 (± 2.15)	-33%

Cobia	<i>Rachycentron canadum</i>	0 (± 12.71)	0.5 (± 0.5)	0.5 (± 0.5)	0.5 (± 0)	0%
Pomfret	<i>Parastromateus niger</i>	240	48 (± 18.7)	0	120	200%
Teleost undifferentiated	Class <i>Actinopterygii</i>	157	31.4 (± 21.6)	0	78.5	200%
Giant Queenfish	<i>Scomberoides commersonnianus</i>	139	34.8 (± 23.5)	0	69.5	200%
Boofhead catfish	<i>Sciades leptaspis</i>	1	1	0	1	200%
Barred Javelin	<i>Pomadasys argenteus</i>	1	1	0	0.5	200%
<i>Mackerels Grouped</i>	<i>Scomberomorus spp.</i>	-5.0 (± 3.9)	115.7 (± 56.1)	56.1 (± 120.7)	1.1 (± 0.5)	200%
<b>Shark</b>						
Blacktip Whalers	<i>Carcharhinus tilstoni</i> & <i>Carcharhinus limbatus</i>	24.1 (± 101.8)	22.9 (± 10.2)	9.1 (± 4.8)	28.1 (± 19.3)	86%
Spot-tail shark	<i>Carcharhinus sorrah</i>	-3.8 (± 12.15)	1 (± 0.6)	3.4 (± 2.3)	3.5 (± 1.62)	-109%
Pigeye & bull sharks	<i>Carcharhinus amboinensis</i> & <i>Carcharhinus leucas</i>	-0.7 (± 3.8)	0.3 (± 0.3)	1 (± 0.6)	0.7 (± 0.2)	-100%
Milk & Hardnose Sharks	<i>Rhizopriondon acutus</i> & <i>Carcharhinus macroti</i>	10	2.5 (± 1.5)	0	5	200%
Creek Whaler	<i>Carcharhinus fitzroyensis</i>	7	7	0	3.5	200%
Carcharhinus undifferentiated	<i>Carcharhinus spp.</i>	5	2.5 (± 1.5)	0	2.5	200
Blacktip Reef Shark	<i>Carcharhinus melanopterus</i>	2	2	0	1	200%
<i>Whaler Sharks Grouped</i>	<i>Carcharhinus spp.</i>	15.1 (± 10.5)	28.3 (± 11.3)	13.2 (± 5.3)	20.7 (± 7.1)	73%

\*Undifferentiated groups are animals which could not be confirmed to species level in electronic monitoring review only.