



Species Diversity, Conservation Status, and Policy Gaps of Landed Elasmobranchs at Ujungbatu Fish Landing Site, Jepara in Support of SDG 14 (Life Below Water)

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Abstract: This preliminary study aimed to identify species diversity and assess the conservation status of elasmobranchs landed at Ujungbatu Fish Landing Site (TPI Ujungbatu), Jepara, Central Java. Primary data were collected from July to August 2025 using purposive and opportunistic sampling methods. A total of 24 species were recorded - eight shark species and 16 ray species - from a total of 112 specimens. Conservation assessment revealed critical urgency: 36.61% of specimens (n=41) belonged to Critically Endangered (CR) species, including *Sphyrna lewini*, *Aetomylaeus vespertilio*, and three *Rhynchobatus* species from the family Rhinidae. Endangered (EN) and Vulnerable (VU) species collectively comprised 41.96% (n=47), while the remaining 21.43% (n=24) were Near Threatened or Least Concern. Overall, 78.57% of landed elasmobranchs belonged to threatened categories (CR+EN+VU). A significant policy gap was identified: only 42.86% of specimens were covered by CITES Appendices, while several Dasyatidae species classified as EN or VU remain inadequately regulated under international trade mechanisms, despite recent CoP19 (2022) listings. These findings underscore the urgent need for strengthened monitoring, species-specific management strategies, and improved harmonization between national policies and international conservation commitments to support SDG 14.

Keywords: Conservation status; Elasmobranchii; Fisheries management; Species diversity; TPI Ujungbatu

Introduction

Indonesia possesses a vast maritime territory covering approximately 3.50 million km², harbouring abundant marine resource potential (BPS, 2023; KKP, 2022). The marine sector is primarily utilized through capture fisheries (Kusdiantoro et al., 2019), in which, cartilaginous fishes, comprising sharks and rays, collectively known as elasmobranchs, represent a significant component of capture fisheries making Indonesia globally recognized as the largest harvester, producer, and distributor of elasmobranchs (Dent & Clarke, 2015), making it a critical focus for global

fisheries management and trade regulation (Bräutigam et al., 2016).

Annual production statistics showed relative stability between 2005 and 2014, averaging 104,898 tonnes per year (KKP, 2012). However, since 2015, Indonesian elasmobranch production has experienced a notable downward trend owing to fin export bans and increased regulatory oversight (KKP, 2012). On average, sharks and rays account for 46.00% and 54.00% of this total production, respectively (KKP, 2012). Indonesia's waters are home to at least 221 elasmobranch species, comprising sharks, rays, and chimaeras (Fahmi, 2010; White et al., 2006), with at least 88 shark species actively

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Given the intensity of exploitation, many elasmobranch species in Indonesian waters now face elevated extinction risks. Consequently, numerous species are now listed in the IUCN Red List and CITES Appendices. Global assessments indicate that over one-third (37.00%) of all shark and ray species face extinction risk, with 391 species classified as Threatened (Dulvy et al., 2021; IUCN, 2024; Sukmaningrum et al., 2022). Studies indicate that species such as the silky shark (*Carcharhinus falciformis*) and various wedgefishes (*Rhynchobatus* spp.) are listed under CITES Appendix II to regulate their international trade (Taufik et al., 2024; Yudha et al., 2022). Specifically, *Rhynchobatus australiae* has been identified as Critically Endangered, highlighting the urgent need for conservation (Sukmaningrum et al., 2022). Despite these global assessments, localized catch data and species-specific threat evaluations remain critically limited in Indonesia, particularly at major landing sites where mixed-species catches complicate monitoring efforts.

While the Indonesian government has implemented several legal instruments—ranging from the total protection of sawfish (*Pristis pristis*) to the regulated protection of whale sharks, oceanic whitetip sharks, and hammerhead sharks—legal coverage remains limited. A significant number of species found in Indonesian waters lack national protection. For instance, international resolutions such as the prohibition of thresher shark (*Alopias* spp.) catches by the Indian Ocean Tuna Commission (IOTC) are now legally binding through PERMEN KP No. 61/2018 (PERMENKP, 2018), which explicitly prohibits the capture and export of thresher sharks and oceanic whitetip sharks. This regulatory gap is further exacerbated by a policy focus that prioritizes economic sovereignty over conservation and a lack of species-specific exploitation limits. Additionally, enforcement of existing regulations at the landing site level remains inconsistent, with limited capacity for species identification among fisheries officers and traders. Therefore, comprehensive scientific data is urgently required as a foundation for formulating more effective and sustainable resource management strategies.

Jepara Regency in Central Java remains one of the prominent regions in Indonesia actively involved in both local and export trade of sharks and rays. The Ujungbatu Fish Landing Port (TPI Ujungbatu) serves as the second-largest fishery centre in the regency, following TPI Demaan (Pujiyanto et al., 2013). Records indicate that the highest number of fishing vessels in Jepara, reaching up to 1,673 units, are landed at TPI Ujungbatu (Imron et al., 2021). The catch composition at TPI Ujungbatu is dominated by economically important

pelagic fish, specifically tuna, mackerel tuna, largehead hairtail, and milkfish.

Furthermore, sharks and rays constitute a significant bycatch and targeted catch component with substantial economic value for both domestic markets and international export. The commercial value of these elasmobranchs is largely driven by their fins for the export market, their meat for processed smoked products, and their skin, which is utilized as raw material for leather handicrafts such as bags. However, despite the economic significance of elasmobranch landings at this site, comprehensive baseline data on species composition, catch frequency, and conservation status remain insufficient.

Conducting research on the biodiversity and conservation status of sharks and rays at the Ujungbatu Fish Landing Port (TPI Ujungbatu) is of paramount importance. This urgency arises from the current lack of comprehensive information regarding the specific species caught by fishermen and landed at this site. Fundamental data, including catch records, species diversity, and conservation status, are essential for formulating effective management strategies to ensure the long-term sustainability of the elasmobranch populations. Moreover, such baseline information is critical for (1) evaluating compliance with CITES trade regulations, (2) identifying priority species for national protection policies, and (3) establishing evidence-based fishing quotas and seasonal closures. Using purposive and opportunistic sampling approaches, this study provides the first comprehensive baseline dataset for elasmobranch conservation management at this critical landing site. Therefore, this study aims to identify the species diversity and assess the conservation status of sharks and rays landed at TPI Ujungbatu.

Method

Study Area and Period

The research was conducted at the Ujungbatu Fish Landing Port (TPI Ujungbatu) in Jepara Regency, Central Java (6°34'58"S, 110°39'27"E). Primary data and sample collection were carried out from July to August 2025. This timeframe was strategically selected to align with the peak availability of samples in the field. The specimens were obtained directly from the catches landed by local fishermen at TPI Ujungbatu. Field visits were conducted according to the ship unloading schedule, generally on weekdays (Monday–Friday), with each sampling session lasting approximately two hours in the early morning (06:00–08:00 WIB, UTC+7).

Sampling Design

Data collection employed two complementary survey approaches to ensure comprehensive coverage. Initially, a purposive sampling method was utilized, specifically targeting sharks and rays landed at the site. Recommendations from local fish-smoking partners, who assisted in sample procurement, were also considered based on the availability of target species. Subsequently, an opportunistic sampling method was applied. This approach was necessary due to the dependency on the availability of shark and ray individuals being processed by smoking partners during the survey period. Consequently, samples were collected based on their accessibility and immediate availability without random selection intervention.

According to Sugiyono (2015), purposive sampling is a technique where samples are selected based on specific criteria—in this study, the taxonomic group (*elasmobranchii*) and the specific location (TPI Ujungbatu). Meanwhile, opportunistic sampling is a non-probability technique where sampling units are chosen based on ease of access and availability at a given time and location. As Ilker et al. (2015) noted, this method relies on subjects that are easily reachable, making it highly relevant for this study given the unpredictable nature of fish landings. Sample selection prioritized obtaining at least one individual per species, with efforts to include both male and female specimens whenever possible to ensure sex-representative data. In cases where there is abundance of samples, all sample will be collected if possible.

Data Collection Procedure

Samples were acquired through direct purchase or permission from fishermen and fish traders at TPI Ujungbatu. Upon landing, elasmobranch specimens were visually inspected and selected based on the study's taxonomic focus. To contextualize the fishery dynamics, semi-structured interviews were conducted with eleven fishermen and fish traders to gather information on fishing gear types (e.g., gillnet, longline, trawl), fishing grounds (distance from shore, depth range), target versus bycatch species, and seasonal catch patterns. Interview data were recorded using a structured questionnaire and field notes. Fishermen were selected based on their willingness to participate and their active involvement in elasmobranch landings during the study period. All interviewed respondents were informed of the research objectives and provided verbal informed consent prior to participation. No institutionally regulated ethics board approval was required for this non-invasive, observational field study; however, all data collection and sample procurement

complied with applicable Indonesian fisheries regulations.

Biological Data Recording

For each collected specimen, the following biological data were recorded: For sharks, Total Length (TL) was measured from the tip of the snout to the end of the caudal fin using a measuring tape to the nearest 0.10 cm. For rays, Disc Width (DW) was measured across the widest point of the pectoral disc, as DW is the internationally standardized metric for batoid measurement and is more reliable than TL in landed specimens where tails may be damaged, while body weight was recorded using a spring scale to the nearest 0.01 kg. Sex determination was performed by classifying individuals as male or female based on the presence of claspers. Males were identified by the presence of paired claspers on the pelvic fins, while females lacked these structures. Additionally, each individual was photographed in lateral view using a digital camera for visual records and potential re-verification of species identification. All biological data were recorded in a standardized field data sheet and subsequently digitized into Microsoft Excel for analysis.

Species Identification

Collected samples were identified using authoritative taxonomic guides, including "*Economically Important Sharks and Rays of Indonesia*" (White et al., 2006), "*Rays of The World*" (Seret et al., 2016), and the "*Identification Book for National Priority Elasmobranchs at Landing Sites*" (KKP, 2023).

Identification was performed through morphological observation, focusing on body shape, snout/head structure, fin position and shape, coloration, and patterns. Samples were identified to the species level whenever possible. In cases where species-level identification could not be definitively determined, specimens were classified to the genus level followed by the "sp." designation. For ambiguous specimens, photographic evidence was cross-referenced with online taxonomic databases and/or guidelines as mentioned before. Consultation with elasmobranch experts from Elasmobranch Project Indonesia (EPI) and Impact Blue Sea Foundation (IBSF) regarding samples taxonomy was also conducted to ensure identifications accuracy.

Conservation Status Assessment

Following species identification, the conservation status of each taxon was assessed by cross-referencing with internationally recognized databases. Conservation categories (Critically Endangered [CR], Endangered [EN], Vulnerable [VU], Near Threatened [NT], Least Concern [LC], Data Deficient [DD]) were retrieved from the IUCN Red List of Threatened Species database

(version 2024-1, accessed on August 2025) via <https://www.iucnredlist.org>. Trade regulation status (Appendix I, II, III, or Not Listed) was verified using the CITES Species Database (accessed in August 2025) via <https://checklist.cites.org>. For species not listed in either database, the status was recorded as "Not Evaluated" (NE) for IUCN or "Not Recorded" for CITES. Conservation status data were compiled into a matrix table alongside taxonomic and biological information for subsequent analysis.

Data Analysis

Data analysis was conducted using descriptive statistics to characterize species composition, catch frequency, and conservation status distribution. The total number of taxa (species and genus-level identifications) was enumerated, and samples were categorized by taxonomic order and family. Frequency and percentage of each species relative to total catch were calculated using the formula: Relative Frequency (%) = (Number of individuals of species *i* / Total number of individuals) × 100. Sharks and rays were analysed separately to determine their proportional contribution to total landings, and dominant species (those comprising >10% of total samples) were identified.

For conservation status distribution, samples were grouped by IUCN Red List categories (CR, EN, VU, NT, LC), and the proportion of threatened species (CR + EN + VU) relative to total catch was calculated. CITES Appendix status was cross-tabulated with IUCN categories to identify policy gaps (i.e., threatened species lacking trade regulation). For species with ≥2 individuals, sex ratios (male:female) were calculated and tested for deviation from 1:1 using a chi-square test for species with sufficient sample sizes (expected cell frequency ≥5), and Fisher's exact test for species with *n* < 5 per cell ($\alpha = 0.05$). All statistical analyses were performed using Microsoft Excel 2019 (Microsoft, 2018) and statistical software if applicable, e.g., SPSS (IBM, 2020). Results were presented in tabular and graphical formats to facilitate interpretation.

Result and Discussion

Species Compositions and Diversity

Fishery landings in the Jepara region are highly diverse, as there are no species-specific restrictions on the capture of sharks and rays. Consequently, this study collected samples of various shark and ray species based on their availability at the landing site. Sample selection was determined by obtaining at least one individual specimen per species, with an emphasis on including both sexes whenever possible. A total of 112 elasmobranch specimens were recorded during the

study period, comprising 21 sharks (18.75%) and 91 rays (81.25%). This disproportionate composition indicates that rays constitute the dominant component of elasmobranch landings at TPI Ujungbatu, while sharks represent a minority component of elasmobranch landings.

The collected specimens were classified by species, and following identification, the specimens were organized taxonomically by order, family, genus, and species. The results of the classification highlight the diversity of elasmobranchs at TPI Ujungbatu, identifying seven distinct shark species and 15 distinct ray species. Additionally, two samples were identified to the genus level but could not be determined at the species level (*Carcharhinus* sp. for sharks and *Pateobatis* sp. for rays).

This brings the total number of identified species to eight shark species and 16 ray species, representing 24 distinct taxonomic units. In total, 112 samples were recorded, comprising 21 shark samples and 91 ray samples. The inability to identify certain specimens to species level reflects common taxonomic challenges associated with juvenile specimens, morphologically similar species complexes, or damaged specimens that lacked diagnostic features. Such limitations underscore the need for molecular approaches (e.g., DNA barcoding) to complement morphological identification in future studies.

Shark Species Composition and Conservations Status

The overall catches obtained by local fishermen contained a relatively small proportion of sharks, confirms that sharks represent a minority component of elasmobranch landings. Consequently, a minimum of one sample per species was established for the shark specimens collected from these landings. In instances where the catch consisted of two or more individuals of the same species, samples were selected to represent both sexes, with at least one individual per sex whenever possible. The shark species utilized as samples in this study are detailed in Table 1.

The order Carcharhiniformes represents the most dominant taxonomic group, exhibiting significant species diversity compared to other orders. Within the Carcharhinidae family, four species were recorded with varying sample densities, where *Carcharhinus* sp. showed the highest frequency (*n* = 6). Identification at the genus level (*Carcharhinus* sp.) indicates common taxonomic challenges associated with juvenile specimens or those with similar morphologies (complex morphotypes), which often necessitate further molecular analysis for species confirmation (Maes et al., 2020). The dominance of Carcharhiniformes is consistent with the tropical Indo-Pacific elasmobranch fauna,

where requiem sharks (Carcharhinidae) and hammerhead sharks (Sphyrnidae) are frequently encountered in coastal fisheries (Gaither et al., 2016).

The species *Carcharhinus sealei* and *Carcharhinus melanopterus* are categorized as Vulnerable (VU) by the IUCN. The presence of these species in the data reflects persistent anthropogenic pressure within coastal habitats. Specifically, *C. melanopterus* serves as an apex predator in coral reef ecosystems, whose presence is highly dependent on the integrity of benthic habitats (Roff et al., 2016). The protection status of these species under CITES Appendix II mandates strict regulation of international trade to prevent overexploitation within Indonesian waters, which serve as a global centre for shark biodiversity (Fahmi et al., 2015).

However, implementation of CITES regulations at the local landing site level remains challenging, as many fishermen and traders lack the capacity to distinguish between morphologically similar *Carcharhinus* species, potentially leading to misidentification and unreported trade of protected species (Sant et al., 2021).

The discovery of *Sphyrna lewini* (Scalloped Hammerhead) in the sample records ($n = 1$) confirms the presence of a taxon categorized as Critically Endangered (CR). Despite the low sample size, its biological significance is paramount, given that *S. lewini* possesses vulnerable life-history characteristics, such as relatively low fecundity and late sexual maturity (Gallagher & Klimley, 2018). The enforcement of CITES Appendix II status for this species in Indonesia still faces implementation challenges at the artisanal fishery

landing sites, where fin identification often encounters functional ambiguity (Prasetyo et al., 2021). The capture of even a single CR-listed individual highlights the vulnerability of hammerhead populations in Jepara waters and warrants immediate attention for bycatch mitigation strategies, such as the use of circle hooks or time-area closures during pupping seasons (O'Farrell, 2021).

The order Orectolobiformes, represented by the family Hemiscylliidae, exhibits distribution patterns associated with benthic habitats. Species from the genus *Chiloscyllium*, namely *C. plagiosum* and *C. punctatum*, are classified as Near Threatened (NT). Although not listed in the CITES Appendices, population trends for these species show a decline due to coral reef habitat degradation and unreported bycatch activities (Seret et al., 2016). These benthic sharks, commonly known as bamboo sharks or cat sharks, are frequently caught in bottom-set gillnets targeting demersal fish and crustaceans. Their slow growth rates and site fidelity make them particularly vulnerable to localized depletion (Harshan et al., 2024).

Galeocerdo cuvier (Tiger shark) reveals a discrepancy between global conservation status and administrative records. Despite its Near Threatened (NT) status, this species is not yet included in the CITES regulatory categories in Indonesia, indicating a need for periodic evaluations of priority species lists within Indonesia's National Plan of Action (NPOA) for Shark and Ray Conservation (KKP, 2021).

Table 1. Shark Sample Classification and Conservation Status (CITES, 2023; IUCN, 2024)

Order	Family	Species	Recorded Samples		Conservation Status	
			n	%	CITES	IUCN
Carcharhiniformes	Carcharhinidae	<i>Carcharhinus sealei</i>	2	9.52	App. II	VU
		<i>Carcharhinus sp.</i>	6	28.57	App. II	NL
		<i>Galeocerdo cuvier</i>	5	23.81	NL	NT
		<i>Rhizoprionodon oligolinx</i>	2	9.52	NL	NT
		<i>Sphyrna lewini</i>	1	4.76	App. II	CR
Carcharhiniformes	Carcharhinidae	<i>Carcharhinus melanopterus</i>	2	9.52	App. II	VU
		<i>Chiloscyllium plagiosum</i>	1	4.76	NL	NT
		<i>Chiloscyllium punctatum</i>	2	9.52	NL	NT
TOTAL			21	100		

Note: n = number of samples; % = relative frequency; CITES status: App. II = Appendix II, NL = Not Listed; IUCN categories: CR = Critically Endangered, VU = Vulnerable, NT = Near Threatened, NL = Not Listed

Furthermore, the data gap in the CITES column for *Rhizoprionodon oligolinx* underscores the necessity for database synchronization between the Management Authority and the Scientific Authority at the national level. The tiger shark is a highly migratory apex predator with a broad dietary niche, making it susceptible to cumulative fishing pressure across multiple jurisdictions. Its absence from CITES listings may reflect

its relatively stable global population compared to more threatened shark species, yet localized populations in overfished areas such as Java may warrant additional protection measures (Holmes et al., 2012).

Rays Species Compositions and Conservation Status

There is a significant difference in the composition of shark and ray landings at TPI Ujungbatu. Local

fishermen's catches consist of a higher proportion of ray species compared to sharks. Consequently, the number of samples obtained for rays frequently exceeded the minimum threshold of one per species, with most species represented by an average of two to four

individuals. Furthermore, the diversity of ray species recorded was twice as high as that of sharks. Detailed information regarding the ray species sampled in this study is presented in Table 2.

Table 2. Ray Sample Classification and Conservation Status (CITES, 2023; IUCN, 2024)

Order	Family	Species	n	%	CITES	IUCN
Myliobatiformes	Dasyatidae	<i>Brevitrygon heterura</i>	7	7.69	NL	VU
		<i>Himantura undulata</i>	1	1.10	NL	EN
		<i>Maculabatis gerrardi</i>	12	13.19	App. II	EN
		<i>Maculabatis pastinacoides</i>	10	10.99	App. II	EN
		<i>Neotrygon orientalis</i>	7	7.69	NL	LC
		<i>Pateobatis fai</i>	2	2.20	App. II	VU
		<i>Pateobatis jenkinsii</i>	2	2.20	App. II	EN
		<i>Pateobatis sp.</i>	1	1.10	App. II	NL
		<i>Pateobatis uarnacoides</i>	1	1.10	App. II	EN
		Subtotal	43	47.25		
	Gymnuridae	<i>Gymnura poecilura</i>	1	1.10	NL	VU
	Myliobatidae	<i>Aetobatus ocellatus</i>	4	4.40	NL	EN
		<i>Aetomylaeus nichofii</i>	3	3.30	NL	VU
		<i>Aetomylaeus vespertilio</i>	1	1.10	NL	CR
Subtotal	9	9.89				
Rhinopristiformes	Rhinididae	<i>Rhynchobatus australiae</i>	34	37.36	App. II	CR
		<i>Rhynchobatus laevis</i>	2	2.20	App. II	CR
		<i>Rhynchobatus springeri</i>	3	3.30	App. II	CR
		Subtotal	39	42.86		
TOTAL			91	100.00		

Note: n = number of samples; % = relative frequency; CITES status: App. II = Appendix II, NL = Not Listed; IUCN categories: CR = Critically Endangered, EN = Endangered, VU = Vulnerable, LC = Least Concern, NL = Not Listed.

Observational data indicates that the order Myliobatiformes is dominated by the Dasyatidae family, with *Maculabatis gerrardi* (n = 12; 10.71% of total samples) and *Maculabatis pastinacoides* (n = 10; 8.93% of total samples) being the most frequently encountered species within the family. Taxonomically, the dominance of the genera *Maculabatis* and *Pateobatis* reflects the characteristics of coastal waters, which serve as the primary habitat for this group of rays. However, a critical analysis of their conservation status reveals a worrying contradiction: the majority of these species fall into the Endangered (EN) and Vulnerable (VU) categories according to the IUCN. While several genera (notably *Maculabatis* and *Pateobatis*) have been listed under CITES Appendix II following CoP19 (2022), full national implementation of these listing decisions in Indonesia remains an area requiring substantially strengthened enforcement.

The absence of CITES regulations for threatened species such as *Pateobatis jenkinsii* (EN) and *Himantura undulata* (EN) indicates a policy gap that may trigger unsupervised exploitation. Population declines in this group are generally driven by high bycatch intensity and the degradation of mangrove and coral reef habitats that function as nursery grounds (Dulvy et al., 2021; Kyne et al., 2020). Stingrays of the Dasyatidae family are

particularly vulnerable due to their K-selected life-history traits, including low reproductive output (typically 1-4 pups per litter), late maturity, and long gestation periods. These biological constraints limit population recovery rates, making them highly susceptible to overfishing even at moderate exploitation levels (Clark-Shen et al., 2025). The finding of *Aetomylaeus vespertilio* (CR) in very low sample numbers (n = 1) underscores the critical condition of this taxon, where low population resilience to anthropogenic pressures could lead to local extinction if not immediately intervened through full national protection. This species, commonly known as the ornate eagle ray, is highly prized in international aquarium trade and as a target for trophy fishing, further exacerbating pressure on wild populations (Araujo et al., 2020).

Analysis of the order Rhinopristiformes reveals a very high conservation urgency, particularly for the Rhinididae family. The species *Rhynchobatus australiae* (Bottlenose wedgefish) was recorded as having the highest sample frequency among all observed taxa (n = 34). The high landing figures for this Critically Endangered (CR) species, which is listed in CITES Appendix II, indicate significant targeted fishing pressure in the region. The dominance of *R. australiae* in

the catch suggests that this species is a desirable bycatch rather than incidentally caught, likely driven by the high market value of its fins in international trade. Wedgefish fins are among the most valuable elasmobranch products, fetching premium prices in East Asian markets (Clarke et al., 2006; Jabado, 2019).

Wedgefish are one of the highest-value elasmobranch commodities due to the superior quality of their fins in the global market. Although listed in CITES Appendix II, the high sample numbers suggest that the implementation of export quotas and monitoring at local landing sites still requires substantial strengthening (Friedman et al., 2018). Furthermore, the presence of *Rhynchobatus laevis* (CR) and *Rhynchobatus springeri* (CR) in the data confirms that the study area is a critical habitat for the Rhinid species complex, which is globally on the verge of functional extinction (Alghozali et al., 2023). All three *Rhynchobatus* species recorded in this study are characterized by extremely low productivity (fecundity of 2-8 pups per litter, biennial reproductive cycles, and maturity ages exceeding 10 years), making population recovery from exploitation nearly impossible without immediate and complete fishing moratoriums (Jabado, 2018; Kyne et al., 2011; Kyne et al., 2020).

Conservation Implication and Policy Gaps

Data integration between sample counts and conservation status highlights the need for harmonization between national policies (Ministry of Marine Affairs and Fisheries decrees) and international commitments. The high variability in status from Least Concern (LC) to Critically Endangered (CR) requires a species-specific management approach rather than a generalist one.

Of the 112 specimens recorded, 41 individuals (36.61%) belonged to species classified as Critically Endangered, 30 individuals (26.79%) were Endangered, and 17 individuals (15.18%) were Vulnerable. Collectively, threatened species (CR + EN + VU) accounted for 78.57% of total landings (n = 88), indicating that the vast majority of elasmobranch catch at TPI Ujungbatu comprises species at elevated extinction risk.

Furthermore, only 48 specimens (42.86%) belonged to species regulated under CITES Appendices (all under Appendix II), while 64 specimens (57.14%) were from species not covered by international trade regulations. This policy gap is particularly pronounced within the Dasyatidae family, where several species remain inadequately protected, classified as Endangered or Vulnerable by the IUCN but remain unregulated by CITES. Such discrepancies create regulatory loopholes that enable continued exploitation and international

trade of threatened species without proper monitoring or sustainability assessments.

Synchronization of landing data with Non-Detriment Findings (NDF) mechanisms is an absolute prerequisite to ensure that the utilization of CITES-listed species, especially from the order Rhinopristiformes, does not threaten the survival of populations in the wild. The absence of robust NDF processes in Indonesia means that export permits for CITES Appendix II species may be issued without adequate scientific evidence that trade is non-detrimental to wild populations. This is particularly concerning for wedgefish species, where localized depletion has been documented across Southeast Asia despite CITES listings. Whereas in Indonesia there are regulations regarding the concern of The Utilization of Protected Fish Species and/or Fish Species Listed in the CITES Appendix written with Regulation Number 61/PER-MENKP/2018 (Dewi et al., 2021; PERMENKP, 2018).

Additional management interventions urgently needed encompass species-specific catch quotas based on robust population assessments, seasonal closures during peak reproductive periods, minimum size limits to protect juveniles and pre-reproductive individuals, mandatory reporting and monitoring systems at all major landing sites, and sustained capacity-building programmes for fisheries officers and traders in elasmobranch species identification to improve data accuracy and enforcement of existing regulations.

Conclusion

The findings reveal a severe conservation crisis, as a disproportionately high proportion of landed species are categorized with elevated threat levels on the IUCN Red List. Critically Endangered (CR) species comprised 36.61% of total landings (n = 41), including *Sphyrna lewini*, *Aetomylaeus vespertilio*, and three *Rhynchobatus* species (*R. australiae*, *R. laevis*, and *R. springeri*). Endangered (EN) and Vulnerable (VU) species collectively accounted for 41.96% of specimens (n = 47), indicating that threatened species (CR + EN + VU) represented 78.57% of total catch. Notably, *Rhynchobatus australiae* showed the highest sample frequency among all observed taxa (n = 34; 30.36% of total elasmobranchs), suggesting significant targeted fishing pressure despite its Critically Endangered status and CITES Appendix II listing. Furthermore, the study identifies a significant regulatory gap between international conservation assessments and trade regulation mechanisms. While 78.57% of specimens belonged to IUCN-listed threatened categories, only 42.86% were regulated under CITES Appendices, with the remaining 57.14%, predominantly from the Dasyatidae family, which,

despite recent CITES CoP19 (2022) listings for some genera, still requires strengthened national implementation of trade regulations given the Endangered or Vulnerable status of these species. These findings underscore the urgent need for species-specific management strategies, strengthened monitoring systems at local landing sites, and improved harmonization between national policies and international conservation commitments to ensure the long-term sustainability of these populations. Future research should prioritize multi-season monitoring to capture temporal variability in elasmobranch catch composition, molecular species identification (e.g., DNA barcoding) to resolve genus-level ambiguities particularly within *Carcharhinus* and *Pateobatis* complexes, and sustained capacity-building programs for fisheries officers and traders at TPI Ujungbatu to improve species identification accuracy and enforcement of existing national and international regulations.

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Conflicts of Interest

The authors declare no conflict of interest. All data and research outputs remain the intellectual property of the authors, and the funders had no influence on the research process.

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