

Peacock Bass Angling: A Preliminary Profiling of Recreational Anglers for Invasive-Species Management in Malaysia

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ABSTRACT

Recreational angling for peacock bass (*Cichla* spp.) has expanded rapidly across Peninsular Malaysia, yet the species is non-native and the anglers who pursue it remain poorly characterised. This preliminary study explores the application of angler profiling as a management-support tool for an invasive recreational fishery. Drawing on recreation specialization, leisure motivation, and the human-dimensions perspective on introduced species, a multidimensional profiling approach was developed and applied to data obtained from 51 anglers attending a peacock bass angling event. Socio-demographic, behavioural, motivational, economic and informational characteristics were coded, and three attitudinal batteries (motivation, conservation/stewardship, and satisfaction/loyalty) were summarised descriptively and examined for internal consistency. The respondents were exclusively male, predominantly aged 21–40, highly experienced and frequent, casting-oriented participants who reported strong intrinsic motivations, a robust stewardship orientation, and high satisfaction and loyalty; awareness that peacock bass is an introduced species was high ($\approx 84\%$). Because the sample was drawn from a single competitive event, these results should be read as a specialist baseline—a characterisation of committed, tournament-active anglers—rather than as a general profile of Malaysian peacock bass anglers, and the very high scale reliabilities ($\alpha > 0.95$) indicate item redundancy that future instruments should address. Interpreted with these caveats, the findings highlight a specialised and management-responsive angler segment and demonstrate the relevance of profiling for segmentation, instrument design and invasive-species governance. A preliminary conceptual framework for profiling peacock bass anglers is proposed, together with propositions (P1–P7) to be validated through probability-based sampling across diverse water-body types and confirmatory modelling. The study thus provides an initial, theory-grounded specialist baseline for the systematic profiling of anglers in Malaysian freshwater fisheries.

Keywords: Recreational fisheries; angler profiling; recreation specialization; leisure motivation; invasive species; peacock bass; human dimensions; Malaysia

INTRODUCTION

Recreational angling is among the most widespread forms of outdoor recreation worldwide, with substantial economic, social and ecological footprints (Arlinghaus et al., 2002; Cooke & Cowx, 2004). In Malaysia, freshwater angling in rivers, reservoirs, ponds and lakes has developed into a popular leisure pursuit, increasingly organised around target species, specialised equipment, online communities and competitive events. One species has become particularly emblematic of this growth: the peacock bass (*Cichla* spp.), a charismatic and hard-fighting Neotropical cichlid prized by sport anglers for its aggressive strikes and its accessibility in lowland reservoirs and rural waterways.

The peacock bass, however, is not native to Malaysian waters. It was introduced from South America and has since established self-sustaining populations across several states, where it is widely regarded as an invasive

species that may compete with, and prey upon, indigenous fishes (Cambray, 2003; Chong et al., 2010). This situation creates a distinctive management tension, in which the recreational resource and the conservation threat are represented by the same animal: the species sustains an enthusiastic angling subculture and associated economic activity, while its spread raises legitimate biodiversity concerns.

Although peacock bass angling has attracted growing popular attention, the anglers themselves remain largely uncharacterised. Fisheries management in Malaysia has historically emphasised the biological dimension—stocking, species composition and ecological impact—whereas the human dimension has received comparatively little systematic attention. Consequently, basic questions remain unanswered: who these anglers are, what motivates them, how specialised and economically committed they are, whether they are aware that their quarry is an introduced species, and whether such awareness translates into stewardship behaviour. In the absence of this information, the design of acceptable regulations, communication and invasive-species interventions is difficult.

The present study, grounded in the human dimensions of recreational fisheries, introduces a preliminary profiling approach for peacock bass anglers in Malaysia, based on the multidimensional characterisation of the anglers and their attitudes. Rather than providing a confirmatory test, the study synthesises established recreation and human-dimensions theory into an integrated profiling approach, applies it to pilot data drawn from a competitive event, and proposes a conceptual framework intended to support subsequent research and management. Consistent with this design, the results are positioned throughout as a specialist baseline rather than a representative account.

Profiling and the Human Dimensions of Invasive-Species Angling

The human-dimensions tradition holds that fisheries are coupled social–ecological systems and that management failures frequently arise from neglecting the human component (Manfredo, 2008; Hunt et al., 2013). Anglers are not interchangeable; they vary systematically in what they seek, how they behave and how they respond to regulation. Profiling—the structured description of an angler population along theoretically meaningful dimensions—constitutes the foundational step that enables segmentation, targeted communication and the design of acceptable management measures (Fedler & Ditton, 1994).

Three bodies of theory inform the profiling dimensions adopted here. First, the theory of recreation specialization conceives of anglers as occupying a continuum from the casual, occasional participant to the committed specialist, expressed through behaviour, investment and psychological commitment, and linked to attitudes, catch orientation and support for management (Bryan, 1977; Ditton et al., 1992; Oh & Ditton, 2006). Second, the recreation experience preference (REP) tradition treats participation as a means to desired psychological outcomes—relaxation and escape, affiliation with nature, social interaction, challenge, and well-being—rather than simply catching fish, and documents a recurring partial disconnect between catch and satisfaction (Driver et al., 1991; Manfredo et al., 1996; Arlinghaus, 2006; Beardmore et al., 2011). Third, satisfaction–loyalty models and the theory of planned behaviour describe whether anglers continue, recommend and support a fishery (Oliver, 1980; Ajzen, 1991). In the specific case of an introduced sport fish, a further consideration applies: awareness that the target species is non-native is a distinct and consequential profiling variable, with no direct analogue in native-species fisheries, because it conditions whether anglers act as advocates for, or partners in the control of, the invasive resource (Cambray, 2003; Gozlan et al., 2010).

MATERIALS AND METHODS

Study Context and Respondents

Profiling was conducted on 51 recreational anglers who participated in a peacock bass angling event held in Peninsular Malaysia. The event was a single-day, catch-oriented competition organised at [venue / reservoir, state] in [month, year], at which participants targeted peacock bass (*Cichla* spp.). Under the tournament format, anglers competed individually or in small teams during a fixed competition window, fishing from the shoreline and small craft. Standard event rules specified rod-and-reel casting with artificial lures, scored entries by the number and length of peacock bass landed, required live handling and prompt release of fish after

measurement, and confined effort to the designated waters. (The specific venue, date and rule set should be confirmed by the authors against the event documentation.)

Recruitment was therefore purposive and event-based. This setting provided efficient access to active, committed peacock bass anglers—a population that is otherwise dispersed and difficult to reach—but it also concentrated sampling on the specialist, competition-oriented end of the angler spectrum. This selection mechanism is an inherent source of bias and is the explicit basis for interpreting the results as a specialist baseline (Section III-E) rather than as a representative sample of Malaysian peacock bass anglers. Participation in the survey was voluntary and anonymous, and questionnaires were completed on-site during the event.

Instrument and Measures

Data were collected using a structured bilingual (English–Malay) questionnaire. The instrument recorded socio-demographic characteristics (gender, age, marital status, education, employment and income); behavioural and specialization characteristics (years of experience, participation frequency, primary fishing method, average trip duration and the types of water bodies fished); economic characteristics (monthly angling-related expenditure and equipment owned); and informational characteristics (sources of angling information). Three multi-item attitudinal batteries were measured on five-point Likert scales (1 = strongly disagree to 5 = strongly agree): motivation (six items), conservation and stewardship orientation (five items), and satisfaction and loyalty (four items).

Two constructs of particular relevance to an invasive fishery—awareness that peacock bass is an introduced species, and catch-and-release behaviour—were captured with single items only. As single-item measures, their internal reliability could not be assessed, and they are treated here as indicative rather than validated; their development into multi-item scales is a priority for future work (Sections III-E and III-F). Open-ended items captured perceived challenges and management suggestions.

Classification of Profiling Characteristics

Following the logic of the three theoretical traditions, the observed characteristics were organised into profiling dimensions according to their role. Socio-demographic, behavioural/specialization, motivational, economic and informational characteristics were treated as antecedent profiling dimensions describing who the anglers are and how they participate. Conservation/stewardship orientation and invasive-species awareness were treated as stewardship and cognitive characteristics. Satisfaction and loyalty were treated as outcome characteristics describing the resilience of participation and the latent support for management. This classification provided the structure for the subsequent analysis and for the proposed framework (Section III-D).

Data Processing and Analysis

Quantitative data were processed descriptively. Categorical characteristics were summarised as frequencies and percentages, and Likert items as means and standard deviations. Internal consistency was estimated for each multi-item battery using Cronbach's α ; because α values much above 0.90 can signal item redundancy rather than desirable reliability, the α estimates are interpreted diagnostically and revisited in Sections III-B and III-F.

The open-ended responses were analysed using thematic analysis. Free-text answers were first transcribed verbatim and translated where necessary; two researchers then independently applied inductive open coding, assigning short descriptive codes to each meaningful segment. Codes were compared, reconciled through discussion, and grouped into higher-order themes (for example, access restrictions, water quality, catch decline, and support for regulation). Theme frequencies were tabulated to indicate salience, and representative statements were retained to illustrate each theme. The single awareness item was coded dichotomously (aware versus not aware/unclear). Because the analysis is preliminary, no inferential modelling of the relationships among dimensions was undertaken; these relationships are instead formulated as propositions (Section III-D) for future confirmatory testing (Section III-F).

RESULTS AND DISCUSSION

Overview of the Angler Profile

The profiling characteristics recorded for the 51 respondents are summarised below according to the classification described in Section II-C. Consistent with the event-based recruitment described in Section II-A, the profile characterises a specialist, competition-active segment and is interpreted throughout as a specialist baseline. The overall profile is internally coherent and locates the respondents toward the specialist end of the recreation-specialization continuum.

Socio-demographic characteristics

The sample was exclusively male (100%) and concentrated in early-to-middle adulthood, with 58.8% aged 21–30 and 31.4% aged 31–40. Just under two-thirds were single (62.7%). Educational attainment was relatively high, with 41.2% holding a bachelor's degree and 29.4% a diploma. Employment was led by the private sector (39.2%), followed by students (21.6%) and the government sector (17.6%); monthly income centred on RM2,001–RM4,000 (43.1%). Respondents clustered in the central and southern states—Melaka (33.3%), Selangor (27.5%) and Johor (17.6%)—consistent with peacock bass angling being centred on the lowland reservoirs and waterways of the central–southern Peninsula. The socio-demographic characteristics are detailed in Table I.

Characteristic	Category	n	%
Gender	Male	51	100
Age	21–30 years	30	58.8
	31–40 years	16	31.4
	41–50 years	3	5.9
	Below 20 years	2	3.9
Marital status	Single	32	62.7
	Married	19	37.3
Education	Bachelor's degree	21	41.2
	Diploma	15	29.4
	Secondary school	13	25.5
	Postgraduate degree	2	3.9
Employment	Private sector	20	39.2
	Student	11	21.6
	Government sector	9	17.6
	Self-employed	8	15.7
	Other	3	5.9
Monthly income	RM2,001–RM4,000	22	43.1

	Below RM2,000	15	29.4
	RM4,001–RM6,000	9	17.6
	Above RM6,000	5	9.8

Table I. Socio-demographic characteristics of respondents (N = 51).

Behavioural and specialization characteristics

The respondents were notably specialised. Most reported long involvement (45.1% more than six years; 17.6% four-to-six years) and high frequency (45.1% weekly; 31.4% several times per month). Casting dominated as the primary method (78.4%), consistent with active lure fishing for a predatory species, and trips were long (47.1% three-to-five hours; 39.2% more than five hours). A wide range of waters was fished, most often rural village streams, lakes and ponds (Table II). These characteristics locate the respondents toward the specialist end of the continuum described by Bryan (1977)—experienced, frequent, method-committed anglers embedded in peer and online networks—that is, the population whose stewardship orientation is theoretically expected to be relatively strong (Ditton et al., 1992; Oh & Ditton, 2006). They are also precisely the anglers a competitive event attracts, reinforcing the specialist-baseline reading of the profile.

Characteristic	Leading categories (n, %)
Experience	More than 6 years (23, 45.1%); 1–3 years (17, 33.3%); 4–6 years (9, 17.6%)
Frequency	Weekly (23, 45.1%); several times/month (16, 31.4%); several times/year (8, 15.7%)
Primary method	Casting (40, 78.4%); bait fishing (6, 11.8%); traditional (2, 3.9%)
Trip duration	3–5 h (24, 47.1%); >5 h (20, 39.2%); <3 h (7, 13.7%)
Waters fished*	Rural village streams (39); lakes (34); ponds (30); recreational streams (25)
Equipment*	Rod & reel (41); artificial lures (39); live bait (24); safety gear (20); boat (16)
Information sources*	Friends/peers (41); social media (37); clubs (23); influencers (21); forums (16)

Table II. Behavioural, specialization, economic and informational characteristics. *Multiple responses permitted; counts exceed N.

Economic and informational characteristics

Monthly angling-related expenditure was distributed across RM100–RM300 (37.3%), RM301–RM500 (23.5%), below RM100 (21.6%) and above RM500 (17.6%), and equipment portfolios were broad, with substantial minorities owning boats, waders, safety equipment and kayaks. This material investment is consistent with the behavioural profile and reinforces the specialised character of the sample. Information reached anglers predominantly through peers and social media, followed by clubs, influencers and online forums (Table II), indicating embeddedness in angling social worlds (Ditton et al., 1992) and identifying the practical channels through which conservation messaging could be delivered.

Analysis of Attitudinal Dimensions

The three attitudinal batteries are summarised in Table III. Intrinsic, non-consumptive motivations dominated: challenge and skill recorded the highest mean ($M = 4.51$), followed by relaxation and nature connection (both $M = 4.43$) and physical and mental well-being ($M = 4.41$), with social motivation also high ($M = 4.29$). Consumptive motivation—fishing to obtain food—was distinctly lower and more variable ($M = 3.80$, $SD = 1.41$). This pattern is consistent with the primacy of non-catch motives documented in the REP literature and

with the reported disconnect between catch and satisfaction among experienced anglers (Arlinghaus, 2006; Beardmore et al., 2011). The motivation battery showed very high internal consistency ($\alpha = 0.96$).

Conservation and stewardship attitudes were strong, led by environmental concern ($M = 4.49$) and the importance of freshwater-ecosystem conservation ($M = 4.43$), followed by regulatory compliance ($M = 4.37$) and willingness to participate in conservation ($M = 4.27$). Catch-and-release adherence was high but the most variable item ($M = 4.00$, $SD = 1.33$), which plausibly reflects the ambivalence of releasing an introduced species; the battery was highly reliable ($\alpha = 0.95$). Outcome characteristics were uniformly high—satisfaction ($M = 4.27$), intention to continue ($M = 4.31$), willingness to recommend ($M = 4.37$) and the view that improved lake and irrigation management would raise participation ($M = 4.41$)—with the highest reliability of the three batteries ($\alpha = 0.97$). The strong endorsement of the management item indicates that anglers perceive management as an enabler of participation rather than as a constraint, providing a favourable basis for co-management.

These reliabilities require cautious interpretation. Although each battery is internally consistent, the α values (0.95–0.97) are high enough to indicate item redundancy—several items within a battery appear to capture nearly identical content—so they are better read as an artefact of overlapping wording, and possibly acquiescent responding within a homogeneous specialist sample, than as evidence of well-differentiated constructs. The uniformly high means point in the same direction. The awareness and catch-and-release constructs, being single items, were not subject to reliability analysis and are reported descriptively. Section III-F sets out how the instrument should be trimmed and expanded before confirmatory use.

Dimension / item	M	SD
Motivation ($\alpha = 0.96$)		
Challenge and skill	4.51	1.07
Relaxation and stress relief	4.43	1.12
Connection with nature	4.43	1.08
Physical and mental well-being	4.41	1.17
Social activity	4.29	1.20
Catching fish for consumption	3.80	1.41
Conservation / stewardship ($\alpha = 0.95$)		
Concern for stream environment	4.49	1.05
Importance of conservation	4.43	1.06
Following regulations	4.37	1.08
Willingness to join conservation	4.27	1.15
Catch-and-release practice	4.00	1.33
Satisfaction / loyalty ($\alpha = 0.97$)		

Management would raise participation	4.41	1.08
Willingness to recommend	4.37	1.08
Intention to continue	4.31	1.12
Satisfaction with experience	4.27	1.15

Table III. Means and standard deviations of attitudinal items (five-point Likert scale; N = 51). Sub-headings report Cronbach's α ; values above 0.95 are interpreted as indicating item redundancy (Section III-F).

Invasive-Species Awareness

Approximately 84% of respondents (43 of 51) indicated awareness that peacock bass is a non-native, introduced species; the remainder were unaware or provided unclear responses. This estimate rests on a single dichotomous item and therefore captures only bare recognition of non-native status, not depth of ecological understanding or perceived management responsibility; it should be read as indicative pending a multi-item measure (Section III-F). Several free-text comments engaged directly with the management dilemma, including calls for permits and bag limits, controlled stocking, and river clean-ups, indicating that a substantial segment is primed to participate in invasive-species governance if appropriately engaged. Perceived challenges centred on access restrictions (no-fishing zones), weather, declining catches and water cleanliness. Taken together with the strong stewardship orientation reported in Section III-B, the high awareness suggests that, at least among specialists, communication need not begin from a low base; the more pressing task is to channel existing awareness into agreed management measures.

Proposed Profiling Framework

Based on the results obtained, it is relevant to propose a preliminary conceptual framework (Fig. 1) for the systematic profiling of peacock bass anglers. The framework organises profiling into five antecedent dimensions (socio-demographic, behavioural/specialization, motivational, economic and informational), which jointly define an angler typology. This typology, in turn, shapes the stewardship and cognitive characteristics (conservation orientation and invasive-species awareness) and the outcome characteristics (satisfaction and loyalty), with all elements operating within, and feeding back into, a management and policy context (stream access, regulation and invasive-species governance) that acts as a moderator.

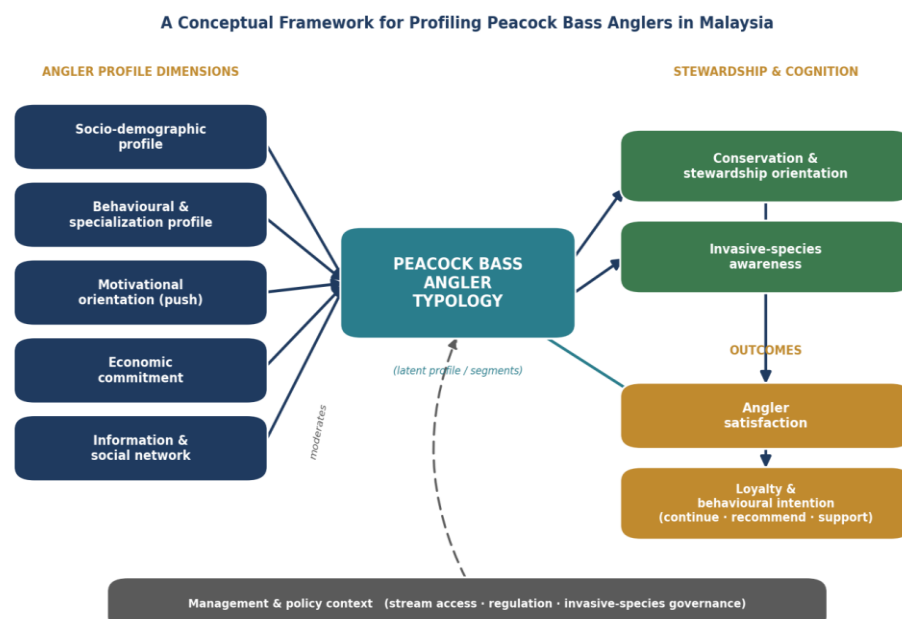


Fig. 1. Preliminary conceptual framework for profiling peacock bass anglers in Malaysia.

To guide application of the framework, the following propositions are advanced for confirmatory testing: (P1) anglers can be classified into a small number of distinct types defined jointly by the five antecedent dimensions; (P2) greater specialization is positively associated with intrinsic, non-consumptive motivation and negatively associated with the relative weight of consumptive motivation; (P3) more specialised anglers exhibit a stronger conservation and stewardship orientation; (P4) invasive-species awareness moderates the relationship between specialization and stewardship, such that aware specialists are the most willing to support invasive-species management; (P5) satisfaction is driven more strongly by intrinsic experiential motives than by catch outcomes; (P6) satisfaction positively predicts loyalty and support for management; and (P7) the management and policy context moderates the translation of angler type into stewardship behaviour and loyalty. The preliminary data reported here are consistent with the descriptive expectations underlying P2, P3 and the high-loyalty pattern of P6, although—given the specialist baseline—confirmatory testing with larger and more representative samples is required.

STUDY SCOPE, LIMITATIONS, AND SELECTION BIAS

The findings must be read within the boundaries set by the sampling design. Respondents were recruited at a single competitive peacock bass event, and event participants are, by definition, among the most committed, skilled and frequently active anglers. The resulting profile therefore represents a specialist baseline—a reference description of tournament-active peacock bass anglers—rather than a general profile of the broader angler population, which will include casual, occasional and non-competitive participants who are likely to differ in motivation, expenditure, specialization and stewardship. The exclusively male, predominantly young and geographically concentrated composition of the sample is itself a product of this selection mechanism and further limits generalisation.

Additional constraints qualify the attitudinal findings. The sample is small; the design is cross-sectional and based on self-report; the awareness and catch-and-release constructs rest on single items; and the scale reliabilities are high enough ($\alpha > 0.95$) to indicate item redundancy rather than construct quality. None of these features invalidates the baseline, but together they bound its interpretation and motivate the refinements set out below. Presenting the results explicitly as a specialist baseline is intended to prevent over-generalisation while still extracting value from a hard-to-reach population.

Directions For Future Empirical Testing

Future work should move from this specialist baseline toward a representative and confirmatory design. First, sampling should be probability-based and stratified across diverse water-body types (reservoirs, rivers, lakes, irrigation ponds and recreational streams) and across regions and access points, combining on-site intercept surveys at both competitive and non-competitive sites with online panels of angling communities, so that casual and non-competitive anglers are represented alongside specialists. Quotas or weighting can then be used to correct the demographic skew observed here.

Second, the measurement instrument should be refined. Redundant items within the motivation, stewardship and loyalty batteries should be trimmed or rewritten to reduce the $\alpha > 0.95$ redundancy and improve discriminant validity, and the two single-item constructs should be developed into multi-item validated scales: an invasive-species awareness scale spanning recognition of non-native status, knowledge of ecological impacts, and perceived management responsibility; and a catch-and-release behaviour scale spanning release frequency, fish-handling and equipment practices, and release intentions. Reverse-coded items and attention checks would help detect acquiescent responding.

Third, with an adequately powered and representative sample, the framework can be tested empirically. Cluster analysis or latent-profile analysis can be used to recover the angler typology and test Proposition P1, while structural equation modelling (SEM) can estimate the measurement model for the refined multi-item scales and test the hypothesised structural relationships in Propositions P2–P7—including the mediating role of the typology and the moderating roles of invasive-species awareness (P4) and the management-policy context (P7). Such a design would convert the present descriptive specialist baseline into a validated, generalisable account capable of supporting segmented communication and evidence-based invasive-species management.

CONCLUSION

This preliminary study presents a profiling approach for recreational peacock bass anglers in Malaysia, grounded in the human dimensions of recreational fisheries. By recognising that an introduced sport fish is simultaneously a valued recreational resource and a conservation concern, the multidimensional characterisation of anglers—their socio-demographic, behavioural, motivational, economic and informational characteristics, together with their stewardship orientation, awareness, satisfaction and loyalty—emerges as a promising basis for understanding and managing this fishery. The profiling of 51 event-attending anglers revealed a specialised, intrinsically motivated, economically committed and socially networked segment with a strong stewardship orientation, high satisfaction and loyalty, and high awareness ($\approx 84\%$) that peacock bass is non-native; importantly, management was perceived as an enabler of participation rather than as a constraint. Because these anglers were recruited at a competitive event, the profile is best understood as a specialist baseline rather than as a general characterisation of Malaysian peacock bass anglers.

The study first enabled a systematic observation and classification of angler profiling characteristics, and subsequently the formulation of a preliminary conceptual framework and a set of testable propositions. Despite limitations associated with the small, self-selected and demographically narrow sample, the single-item awareness and catch-and-release measures, the redundancy implied by the very high scale reliabilities, and the cross-sectional, self-report design, the study provides an initial, theory-grounded specialist baseline for the systematic profiling of anglers in Malaysian freshwater fisheries. As detailed in Section III-F, future work should implement probability-based sampling across diverse water-body types, refine and expand the attitudinal scales—including multi-item measures of invasive-species awareness and catch-and-release behaviour—and apply cluster or latent-profile analysis together with structural equation modelling to validate the framework and test Propositions P1 through P7.

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