Modern dolphin training as a behavioral process: Learning, motivation, social interaction, and cooperative husbandry

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Abstract

Dolphin training is widely used in zoological facilities for public presentations, husbandry, research, veterinary care, and daily management, yet many practical principles remain incompletely formalized in the scientific literature.

This narrative, practice-based review integrates professional training knowledge with learning theory, cetacean cognition, applied animal behavior, veterinary care, and welfare science. It examines reinforcement-based learning, shaping, cue control, reinforcement schedules, behavioral sequencing, motivation, social and observational processes, exploratory interaction, and voluntary participation.

Cooperative husbandry is considered an application of these shared principles that can enable dolphins to participate in medical, reproductive, health-monitoring, rehabilitation, and management procedures with reduced reliance on restraint.

By distinguishing published evidence from illustrative professional examples, the review presents modern dolphin training as a stepwise, individualized, and bidirectional behavioral process rather than simply the production of trained responses.

This framework may support future research and practice in dolphin welfare assessment, comparative cognition, veterinary care, physiological monitoring, and applied animal behavior.

Keywords: dolphins; animal training; reinforcement; motivation; cetacean cognition; cooperative husbandry; animal welfare

Introduction

Dolphin training is widely practiced in zoological facilities for performance, husbandry, research, health care, and daily management. Through training, dolphins can perform complex behaviors, participate in medical procedures, and interact with trainers in structured and flexible ways. Despite its widespread use, however, the practical processes by which dolphin behaviors are acquired, maintained, and adapted across contexts remain incompletely synthesized in the scientific literature. Much of the relevant knowledge remains within professional practice and is rarely formalized within established frameworks of learning theory, animal behavior, and animal welfare

science.

Although dolphin training relies primarily on operant conditioning, including shaping, conditioned reinforcement, cue control, and reinforcement schedules, it also involves broader processes such as social interaction, observational influences, exploratory engagement, motivational regulation, behavioral sequencing, voluntary participation, and welfare-oriented applications (Ramirez, 1999; Pryor, 2002; Brando, 2010; Kuczaj et al., 2012; Lauderdale et al., 2021a).

These features indicate that dolphin training cannot be fully captured by simple conditioning terminology alone.

The present paper aims to organize basic approaches and practices widely shared in dolphin training settings and to make their underlying processes more explicit within established frameworks of learning theory, animal behavior, cetacean cognition, and welfare science.

It is positioned as a narrative, practice-based review rather than a quantitative experimental study or training manual. The scope of the review and the roles of published literature and practice-based examples are described in Section 2.1.

In doing so, the paper seeks to support a more systematic understanding of dolphin training and its significance for animal welfare, comparative cognition, veterinary care, physiological monitoring, and applied animal behavior.

Because the final appearance of trained behaviors may obscure the processes through which they are developed, this review also emphasizes the importance of examining training as a stepwise, interactional, and individualized process.

The same behavioral goal may be reached through different pathways depending on the dolphin's learning history, motivation, social context, health condition, and relationship with trainers.

Understanding modern dolphin training therefore requires attention not only to what dolphins are trained to do, but also to how behaviors are shaped, maintained, adjusted, generalized, and applied in welfare-oriented care.

Core principles and terminology of modern dolphin training

Contemporary dolphin training can be understood through a set of interconnected behavioral principles that structure learning, performance, and interaction in routine zoological practice.

These principles do not function as isolated techniques, but as part of a broader behavioral system involving reinforcement, cue control, behavioral sequencing, and motivational regulation. The conceptual relationships among these components are summarized in Fig. 1.

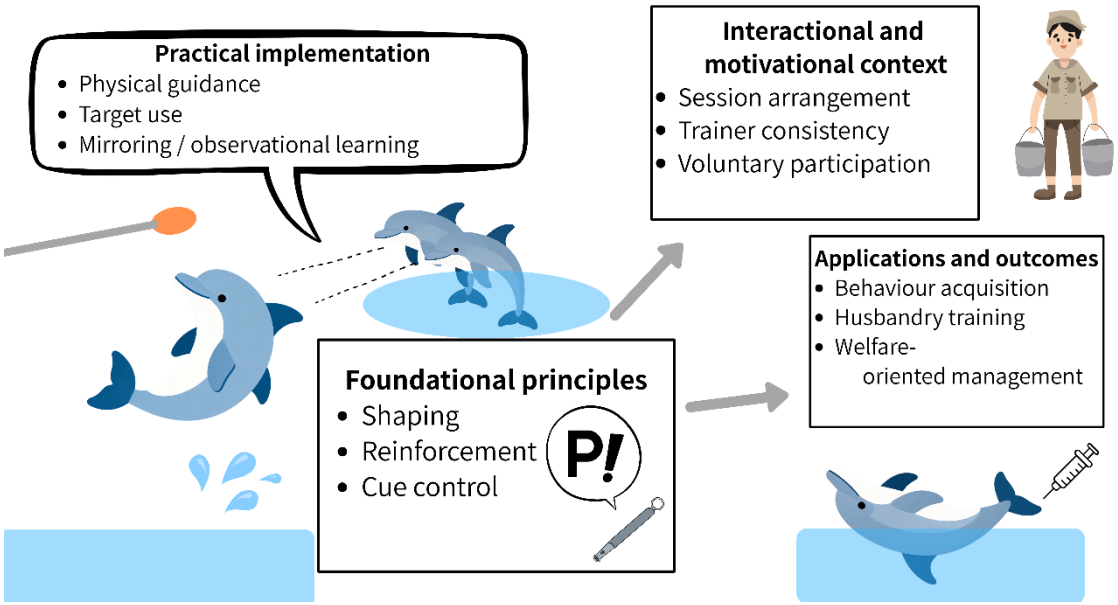

Fig. 1. Conceptual framework of modern dolphin training.

Modern dolphin training can be understood as an integrated system linking foundational learning principles, practical implementation, interactional and motivational context, and applied outcomes. Foundational principles such as shaping, reinforcement, and cue control support practical training procedures, including physical guidance, target use, and mirroring or observational learning. These processes are further influenced by session arrangement, trainer consistency, and voluntary participation, and may contribute to behavior acquisition, husbandry training, and welfare-oriented management.

Scope and review approach

This paper is a narrative, practice-based review rather than a systematic review.

It draws on peer-reviewed research, books, and professional literature on animal training, and illustrative examples from professional dolphin-training practice. Relevant sources were selected purposively for direct relevance to the definitions and applications discussed, with emphasis on peer-reviewed dolphin research and foundational learning-theory literature; no formal search protocol or quantitative study-quality assessment was applied.

These materials are brought together to interpret field-based practices within established concepts from learning theory, cetacean cognition, applied animal behavior, veterinary care, and animal welfare science. The review does not claim exhaustive coverage of all training methods, facilities, or areas of dolphin cognition. Because dolphin training practices vary across facilities, trainers, animals, social groups, and management goals, this review does not attempt to prescribe a single standardized protocol.

Published literature is used to define established concepts and describe documented applications, whereas practice-based material is used to explain aspects of training that remain incompletely represented in the scientific literature.

Practice-based examples are included when they clarify how learning principles, trainer judgment, individual differences, and social context may interact in routine settings.

They are not treated as systematically collected data, comparative evidence, or proof of a specific cognitive or learning mechanism. When more than one interpretation is possible, the discussion distinguishes among plausible processes rather than assigning a mechanism solely from the observed outcome.

Apparently simple or fluent behaviors may depend on multiple approximations, adjustment to individual motivation or physical condition, generalization across trainers or locations, and several forms of reinforcement.

The following sections therefore clarify the terminology used in this review before examining reinforcement, cue control, reinforcement schedules, motivation management, and behavioral sequencing.

Key terminology

Several terms used in dolphin training overlap with established terminology in learning theory and applied animal behavior.

Definitions of reinforcement and formal reinforcement schedules follow standard operant-learning terminology (Ferster and Skinner, 1957), whereas their practical application is interpreted with reference to professional literature on animal and marine mammal training (Ramirez, 1999; Pryor, 2002; Brando, 2010).

Because these terms may be used differently across scientific, veterinary, and professional training contexts, Table 1 defines key terms as they are used in this paper.

These terms are introduced not to prescribe a single training protocol, but to clarify how field-based dolphin training practices are interpreted in this review.

Table 1. Key terms used in this paper

Term	Definition in this paper	Relevance to dolphin training
Primary reinforcer	A reinforcer whose value does not depend on previous learning, such as food.	Food is commonly used in the acquisition and maintenance of trained behaviors, although primary reinforcers are not limited to food.
Conditioned (secondary) reinforcer	A stimulus that has acquired reinforcing value through association with other reinforcers.	Social or trainer-related stimuli, such as vocal praise, clapping, stroking, or other positive trainer responses, may acquire reinforcing value depending on the individual's learning history, preferences, and training context.
Bridge signal	A conditioned signal that marks the moment at which a desired behavioral criterion has been met and bridges the interval between the response and subsequent reinforcement.	In aquatic settings, a bridge signal, typically a whistle, allows precise marking of behavior even when immediate reinforcement is delayed.
Cue	A discriminative stimulus indicating that a particular response is likely to be reinforced in a given context.	Hand signals, body postures, acoustic signals, targets, or contextual cues may indicate which behavior is requested.
Shaping	The gradual development of a target behavior by reinforcing successive approximations.	Complex behaviors can be built step by step by reinforcing changes in posture, movement, timing, duration, or spatial position.
Stimulus control	Reliable occurrence of a behavior in response to a specific cue, and not in response to irrelevant stimuli.	Cue control is essential for husbandry behaviors, multi-individual training, research tasks, and safe human–animal interaction.
Continuous reinforcement	Reinforcement of each correct response during a defined stage of training.	Often used during early acquisition or when a new behavioral criterion is being clarified.
Intermittent reinforcement	Reinforcement of some, but not all, correct responses.	May be used to maintain established behaviors, behavioral chains, or longer sequences.
Variable-ratio (VR) schedule	An intermittent reinforcement schedule in which the number of correct responses required before reinforcement varies.	May be used with established behaviors or behavioral chains. In professional practice, the broader term variable reinforcement may also include variation in reinforcement amount, type, or timing.
Enrichment	Environmental, social, or cognitive opportunities that promote behavioral diversity, engagement, choice, or species-relevant activity.	Some training tasks may overlap with enrichment when they provide challenge, exploration, social interaction, or problem solving.
Voluntary participation	Participation in training or husbandry procedures without physical coercion, with some opportunity for the animal to disengage.	Central to cooperative husbandry, welfare-oriented care, and interpretation of motivation.
Cooperative husbandry	Training that enables animals to participate in veterinary, health-monitoring, management, or care procedures.	Can support procedures such as blood collection, ultrasound examination, respiratory sampling, urine or fecal sampling, reproductive sampling, and body inspection with reduced restraint.
Habituation	A decrease in behavioral responsiveness following repeated exposure to a stimulus that is not associated with harmful consequences.	In dolphin husbandry training, habituation may occur when an animal gradually becomes accustomed to routine handling, equipment, environmental features, or procedural contexts.
Desensitization	A gradual training process in which an animal is exposed to a stimulus, contact, posture, or procedure at a tolerable level so that avoidance, fear, or sensitivity is reduced over time.	Desensitization may be important for touch, medical equipment, unusual postures, clinical procedures, and other husbandry-related stimuli that the animal may initially avoid.
Stationing	A trained behavior in which an animal moves to and remains at a designated location or maintains a specified position until released or cued to perform another behavior.	Stationing allows dolphins to maintain designated locations or positions during training sessions, multi-individual work, public presentations, veterinary procedures, sample collection, and health monitoring.

Reinforcement, shaping, and stimulus control

Dolphin training is based primarily on the principles of operant conditioning. New behaviors are acquired through successive approximations, with trainers reinforcing incremental improvements toward a target response.

During shaping, trainers may focus on one behavioral criterion at a time, such as height, posture, or timing. This helps clarify what is being reinforced at each stage, whereas changing multiple criteria simultaneously may make it more difficult for the animal to identify which aspect of its behavior is being reinforced. Shaping may also be applied after the basic form of a behavior has been acquired to further refine features such as height, posture, timing, trajectory, or overall precision. In this way, complex behaviors can be developed and refined gradually and systematically (Ramirez, 1999; Pryor, 2002).

A bridge signal, typically a whistle, is used to mark the precise moment at which the target criterion has been achieved. This helps the dolphin associate a specific element of its behavior with reinforcement. It is particularly important in aquatic settings, where food or tactile reinforcement cannot always be delivered at the exact moment the response occurs.

In this review, the bridge signal is treated as a conditioned signal that marks the attainment of a behavioral criterion and links the response to subsequent reinforcement (Ramirez, 1999; Pryor, 2002). For example, when a dolphin is being trained to reach a specified height during a jump, the whistle may be sounded at the moment the dolphin reaches that height, thereby clearly identifying the element of the behavior that met the reinforcement criterion.

In professional dolphin-training practice, the form and amount of reinforcement may be adjusted according to the behavioral context. Larger or more energetically demanding behaviors may be followed by a greater quantity of food reinforcement. For example, a whole fish may be provided, or several smaller pieces of fish may be delivered. By contrast, smaller or less physically demanding behaviors may be followed by a reduced amount of reinforcement. Reinforcement may therefore be adjusted through the size, number, and total quantity of food items. However, the type of food used, the way it is divided, the amount delivered, and its allocation may differ according to each facility's feeding policies and management procedures.

Food therefore remains an important primary reinforcer in dolphin training, particularly for the acquisition and maintenance of many trained behaviors.

In addition, conditioned or social reinforcers, including stroking, clapping, vocal praise, and other positive responses from the trainer, may be used alongside food rewards depending on the individual's learning history and current motivational context.

Access to preferred objects, play opportunities, or enrichment activities may also function as reinforcement when it is delivered contingently upon behavior and is valued by the individual. However, this function should be demonstrated rather than assumed simply because the opportunity

is described as “enrichment” (Ramirez, 1999).
These multiple forms of reinforcement may contribute to maintaining both trained behavior and willingness to participate.
Once a behavior has been shaped, it is placed under stimulus control. Cue–behavior associations are established by presenting a cue immediately before eliciting the target behavior.
Beyond routine cue control, bottlenose dolphins have also been shown experimentally to identify objects indicated by human pointing and gaze cues (Pack and Herman, 2004).
Reliable stimulus control is essential because trained responses must occur predictably and consistently across different contexts. In professional practice, the final stage of behavior development often includes confirming that the dolphin can perform the same behavior reliably when the same cue is presented by different trainers, rather than responding only to one particular trainer. Once this generalization has been established, the behavior may be regarded as sufficiently developed and under stimulus control.
Such generalization is important for husbandry procedures, research tasks, multi-individual training, and situations in which behaviors must be performed reliably across different trainers, locations, and social contexts.
In some training contexts, trainers may also provide more open-ended interactive periods in which dolphins are allowed to offer a range of behaviors, from which selected behaviors may then be marked and reinforced.
Experimental research has demonstrated that dolphins can be trained to produce responses that differ from those previously reinforced, indicating that behavioral novelty itself can be brought under reinforcement contingencies (Pryor et al., 1969).
Such behaviors should nevertheless be interpreted in relation to reinforcement history and trainer responses, rather than as evidence of behavior occurring independently of learning.
These interactions differ from standard cue–response tasks because the animal has greater opportunity to offer behavioral variation and explore different behavioral possibilities.
This point is discussed further in Section 3.3, which considers exploratory and play-like interactions in relation to problem solving and willingness to participate.

Continuous, intermittent, and variable-ratio reinforcement schedules

Reinforcement schedules used in dolphin training include continuous and intermittent reinforcement.
Continuous reinforcement refers to reinforcing every correct response during a defined stage of training, whereas intermittent reinforcement involves reinforcing some, but not all, correct responses.
One formal type of intermittent reinforcement is the variable-ratio schedule (VR), in which the number of responses required before reinforcement varies (Ferster and Skinner, 1957).

These definitions provide a basis for distinguishing formal reinforcement schedules from the broader ways in which related terms may be used in professional practice.

Continuous reinforcement is often useful during the acquisition of a new behavior, when a new behavioral criterion is being clarified, or when a response needs to be strengthened again following a period of instability.

Once a behavior has become well established, intermittent reinforcement or VR schedules may be used to maintain reliable responding, longer behavioral sequences, or participation under more variable conditions without reinforcing every correct response.

Food is commonly used as a representative and important primary reinforcer under both continuous and intermittent reinforcement schedules. Tactile or social stimuli, such as stroking, vocal praise, clapping, and attention from the trainer, may also function as reinforcers depending on the individual and the context. Whether such stimuli function as primary, conditioned, or social reinforcers should not be determined solely by how they are labeled, but should instead be evaluated in relation to the individual's learning history, preferences, and their demonstrated effects on behavior.

Such tactile, conditioned, or social reinforcers may be delivered together with, or following, a correct response depending on the individual's learning history, preferences, and current motivational state.

A reinforcement schedule describes the pattern according to which responses are reinforced; it does not, by itself, determine whether the reinforcer is food, tactile interaction, trainer attention, or another stimulus.

In professional practice, the term *variable reinforcement* may be used more broadly than the formal term *variable-ratio schedule*.

Trainers may vary not only the number of responses preceding reinforcement, but also the amount, type, or timing of reinforcement according to the behavioral context. For example, during a public presentation, social reinforcers such as clapping, vocal praise, or trainer attention may be delivered intermittently following correct responses to cues, while a specified amount of food is provided after the presentation. However, the way in which different reinforcers are combined and distributed may vary according to facility policies, the individual's learning history, and the structure of the presentation.

Such practical variation should not automatically be regarded as equivalent to a precisely programmed laboratory schedule.

Distinguishing formal schedules from their broader use in professional practice helps avoid implying that every training arrangement involving variation follows a standardized experimental protocol.

In professional practice, intermittent reinforcement and VR schedules may be adjusted according to the reliability of the behavior, the length and complexity of the task, and the animal's response to the session. When a reinforcement arrangement appears appropriate for an individual, trainers may

observe increased behavioral activity or willingness to participate, faster responses, or greater vigor or clarity of performance. These responses vary among individuals and contexts, and the appropriateness of a reinforcement schedule should not be judged solely on the basis of response speed or activity level. Conversely, trainers may observe declines in response accuracy or continued participation when reinforcement is too infrequent, poorly timed, or unclear in relation to the animal's learning history. Reinforcement schedules should therefore be treated as one component of training design rather than as a uniform progression from continuous reinforcement toward increasingly sparse reinforcement.

Error handling and responses to non-criterion behavior

Responses to behavior that does not meet the trainer's criterion vary across professional training settings. Such responses may include an incorrect response to a cue, a response that does not meet the required criterion, or the performance of an unrequested behavior. These responses may arise from various factors, including, for example, the stage of shaping a new behavior, task difficulty, or reduced motivation to participate.

One approach used in some professional training settings is a brief time-out from reinforcement provided by the trainer. The trainer may temporarily withdraw attention, turn away, increase the distance from the animal, or leave the training position, thereby removing access to eye contact, interaction, and immediate opportunities for reinforcement. For example, the Dolphin Research Center describes the use of time-out when inappropriate behavior occurs, such as one dolphin displacing another individual from the position in front of the trainer, resulting in the temporary withdrawal of trainer attention. Such procedures may function by reducing access to positively reinforcing interaction, although their effects depend on what is reinforcing the behavior in that particular context (Dolphin Research Center, n.d.).

A different approach described by SeaWorld is the Least Reinforcing Scenario (LRS). When an animal does not respond or produces an unrequested response, the response is neither bridged nor reinforced. The trainer continues to observe the animal while remaining relaxed for approximately two to three seconds and attempting to make as little change to the environment as possible. Calm behavior in which the animal attends to the trainer is then reinforced, and the animal may subsequently be given an opportunity to perform another behavior that is likely to result in reinforcement. Thus, the LRS is intended not only to avoid accidental reinforcement of the non-criterion response, but also to provide a rapid pathway for the animal to return to successful participation (United Parks & Resorts, n.d.).

Time-out and LRS should not be treated as identical procedures or as procedures that can be applied uniformly in all situations. A time-out involves the temporary withdrawal of trainer attention or access to reinforcement opportunities. In contrast, during an LRS, the trainer remains present and

introduces a brief interval of minimal responsiveness before reinforcing calm attentiveness and providing another opportunity for success. The relative use of these approaches may vary among facilities, trainers, individual animals, and behavioral contexts (Dolphin Research Center, n.d.; United Parks & Resorts, n.d.).

From a practice-based perspective, inappropriate error handling may make it more difficult for the animal to understand the task and may reduce willingness to participate. Therefore, although specific methods may differ among facilities, error handling in training based on positive reinforcement should be carefully designed and applied consistently.

Motivation as an actively regulated process

In modern dolphin training, motivation is maintained by trainers adjusting session structure, reinforcement, and task difficulty according to the dolphin's responses and condition.

In this paper, motivation is therefore treated not as a fixed internal state, but as an actively regulated process shaped by reinforcement history, predictability, trainer behavior, the individual's condition, and the interactional context of the session.

In practical training, motivation and willingness to participate are often inferred from observable behavioral characteristics rather than measured directly.

Trainers may assess them through response latency, attention to cues and trainer behavior, and the speed, vigor, and accuracy with which behaviors are performed.

Anticipatory behavior has been examined as an indicator of motivation to participate in specific events, including interactions with familiar trainers and access to enrichment objects (Clegg et al., 2018).

Willingness to participate in positive reinforcement training has also been associated with health status and has been shown to decrease before identified changes in health (Clegg et al., 2019).

These indicators are context-dependent and should therefore be interpreted cautiously. Nevertheless, they can provide important information when deciding whether to continue or pause a session, simplify a task, or modify its content.

The structure of a training session may influence both willingness to participate and the degree of success achieved within that session.

Practice-based approaches include presenting new or more difficult tasks when willingness to participate is high, interspersing them with familiar responses, and ending the session following a successful response. In professional practice, a short session of approximately five minutes may sometimes be used as a general guide to the period over which attention can be maintained. However, the appropriate duration varies according to the individual, task difficulty, environment, and the animal's current condition. When the training plan includes the development of a new behavior, determining in advance the tasks to be introduced, the familiar behaviors to be

interspersed, and the criteria for ending the session may help clarify the behavioral criteria and facilitate learning within the limited session period.

These approaches are intended to support continued willingness to participate and the accumulation of a clear history of successful reinforcement. Their effects may nevertheless vary among individuals and contexts.

Trainer behavior may also influence willingness to participate.

Observable patterns such as delayed responding, reduced attention, or gradual disengagement may be associated with trainer-related factors, including inconsistent reinforcement, unclear behavioral criteria, premature cueing, hesitation when presenting cues, or poorly timed reinforcement.

For example, when a less-experienced trainer conducts a session, a dolphin may attempt to leave the training area or discontinue participation. In such a situation, the trainer may sound the whistle to prevent the dolphin from leaving even when the immediately preceding behavior did not meet the intended criterion. This may inadvertently mark a behavior that the trainer did not intend to reinforce. If such responses are repeated, leaving or producing incomplete responses may become associated with reinforcement during sessions with that trainer, making it more difficult to maintain stable behavioral criteria and session progression.

These behaviors should not be interpreted as the animal deliberately “testing” the trainer. Rather, they should be regarded as feedback regarding the clarity and consistency of the interaction between the trainer and the dolphin.

The maintenance of motivation may therefore depend not only on the availability of reinforcement, but also on the timing of trainer responses, the consistency of behavioral criteria, and the predictability of the interaction.

Training progress is not always linear. Even when a behavior has been achieved during a previous session, it may not be reproduced immediately or with the same level of accuracy during the next session. A previously developed behavior or criterion may not yet be firmly established, and the dolphin may not clearly produce the requested response.

In such cases, trainers may temporarily return to an earlier stage, rebuild successful responding step by step, and then proceed to the next stage.

Such progress depends not only on the dolphin’s ability, but also substantially on trainer judgment, including the setting of behavioral criteria, the timing of reinforcement, the recognition of reduced motivation, and decisions about whether to continue, pause, or modify the session.

Behavioral sequencing and cognitive demands

Modern dolphin training may extend beyond the shaping of single behaviors to the organization of multiple behaviors into structured sequences.

Once individual behaviors have been established through shaping and placed under stimulus control,

they can be combined to form more complex tasks.

In this paper, behavioral sequencing refers to the organization of two or more previously established behavioral components into a defined order that must be performed across time, space, or cue context.

One form described in professional training practice involves the successive presentation of multiple cues, with the dolphin required to remember the behavior corresponding to each cue and perform the behaviors in the order in which the cues were presented (Cruz et al., 2014). For example, cues corresponding to a spin, a vocalization, and a jump may be presented in sequence. The dolphin must then perform those behaviors consecutively in the same order, and completion of the entire sequence is marked with a whistle and followed by reinforcement.

In another form used in professional practice, a predetermined sequence of behaviors is placed under the stimulus control of a single cue, and the dolphin performs the entire sequence as one integrated and continuous response. In such a sequence, the trainer may sound the whistle when each component meets its criterion, mark completion of that component, and then proceed to the next behavior. The placement of the bridge signal therefore depends on whether the reinforcement criterion concerns completion of the entire sequence or attainment of the criterion for each individual component.

These forms of behavioral sequencing illustrate that, in complex trained behaviors, the animal may need to respond not only to individual cues, but also to the order, timing, and relationships among behavioral components.

Experimental research with trained bottlenose dolphins has demonstrated comprehension of ordered gestural and acoustic instructions (Herman et al., 1984), gestures that symbolically refer to body parts (Herman et al., 2001), and recall of recently performed actions (Mercado et al., 1998).

These findings do not demonstrate that exactly the same processes are involved in routine performance sequences. However, they show that training can be used to investigate order, representation, and action memory under controlled conditions.

In behavioral sequences, the placement of the bridge signal and the response to errors depend on the criterion being evaluated. Errors may include performing behaviors in the wrong order, omitting or adding a component, or failing to meet the established criterion for an individual behavior. For example, a jump may be insufficient in height, or a spinning jump may fail to reach the required number of rotations.

When an error occurs, the trainer may interrupt the sequence at the relevant component and restart it, or may allow the dolphin to complete the sequence while withholding the final bridge signal or reinforcement. The appropriate response depends on the structure of the sequence, the established behavioral criteria, the individual’s stage of learning, and safety considerations.

Although these continuous sequences may appear to an observer as a single fluent performance, they

are often constructed by shaping smaller behavioral units separately, reinforcing them, linking them in order, and stabilizing the sequence over time.
Because behavioral sequences require the dolphin to retain multiple behaviors in the correct order and perform them at the appropriate time, they may serve not only as trained performances but also as tasks through which action memory, attention, anticipation, and behavioral control can be examined.

Social interaction, exploration, and voluntary participation in dolphin training

Dolphin training is not shaped solely by reinforcement contingencies directed toward isolated individuals.
Because dolphins are highly social animals, training often takes place within a context of interaction involving both trainers and conspecifics.
Social context may therefore influence behavioral acquisition, performance, motivation, and engagement through the presence and behavior of other dolphins.
In addition, dolphins may approach, remain engaged, hesitate, disengage, or stop responding during training.
These responses indicate that training involves an element of voluntary participation rather than simple behavioral control, and that the animal's behavior can provide important feedback to the trainer.
In this paper, bidirectional interaction refers to the way in which both the trainer and the dolphin influence the course of a training session.
The trainer presents cues, reinforcement, criteria, and opportunities for participation, but also adjusts timing, difficulty, session structure, and reinforcement according to the dolphin's responses.
At the same time, the dolphin's behavior may influence whether the trainer continues, pauses, simplifies the task, adjusts reinforcement, checks the animal's condition, or ends the session.
Thus, training is not simply a fixed procedure imposed on the animal, but a dynamic process shaped by ongoing behavioral feedback.
Voluntary participation should be interpreted within a learned training context.
A dolphin may approach, cooperate, remain engaged, or disengage without forceful handling, but these choices remain influenced by reinforcement history, trainer cues, trainer–animal relationships, and established routines.
Non-participation should therefore be treated not simply as failure or non-compliance, but as behavioral information that may prompt the trainer to reconsider the animal's condition, motivation, social context, or the clarity of the task.
Its use in welfare assessment is considered further in Section 5.2.

Social learning and observational processes

Social learning may contribute importantly to dolphin training, particularly when new behaviors are introduced in group settings.

In this paper, social learning is used broadly to refer to learning or performance changes that are influenced by the presence, behavior, or responses of other individuals.

This may include observational learning, social facilitation, following, synchrony, mimic- or mirroring-assisted responses, and, in some cases, imitation, although these processes should not be treated as interchangeable (Yeater and Kuczaj, 2010; Kuczaj et al., 2012).

When a new behavior is introduced to a single individual, other dolphins observing the process may later acquire the behavior more rapidly when trained themselves (Yeater and Kuczaj, 2010; Kuczaj et al., 2012; Nakamura et al., 2025). In some cases, dolphins have appeared to reproduce behaviors of trained individuals, suggesting that observational learning and imitation may contribute to behavioral acquisition.

However, faster acquisition after observation should be interpreted cautiously, because it may also be influenced by prior training history, familiarity with cues, social facilitation, following, synchrony, mimic- or mirroring-assisted responses, or the trainer's shaping procedure.

Observational learning refers here to cases in which the behavior or performance of one individual is influenced by observing another individual's behavior and its consequences.

Imitation is a narrower interpretation, in which the observer reproduces aspects of the demonstrated behavior itself.

Social facilitation, by contrast, may occur when the presence or activity of another dolphin increases attention, arousal, or the likelihood of performing a behavior, without necessarily requiring copying of the behavior's form.

Distinguishing among these processes is important because similar outcomes in practice may arise from different learning mechanisms.

Practical dolphin training may also involve following, synchrony, and mimic- or mirroring-assisted responses, in which another dolphin's movement facilitates initiation or an initial approximation of a target behavior.

Previous work suggests that observing another dolphin's movement can influence subsequent motor performance, and that synchrony and following may provide a pathway toward imitation-like responses (Fellner et al., 2006; Sartori et al., 2015).

Comparative approaches such as the "Do as I Do" method in dogs provide a useful framework for considering learning from demonstrated actions, but do not establish strict imitation in field observations of dolphins (Fugazza and Miklósi, 2017).

Together, these findings indicate that conspecific presence can influence how behaviors are acquired and performed.

In practice, social context may affect acquisition speed and responses to cues without allowing the underlying mechanism to be inferred from the outcome alone.

Illustrative example from practice

The following practice-based example is derived from professional training experience and illustrates how several of the principles discussed above may be combined in the acquisition of a novel jumping behavior.

This example was not collected systematically and is not presented as an experimental demonstration of a single learning mechanism.

First, one dolphin was trained individually through successive approximations.

A target was used to reinforce a vertical jump, and the movement was gradually refined in terms of body use, trajectory, and the location from which the behavior was initiated.

Once the dolphin could reliably initiate the behavior from the designated location, the target was gradually faded, and repeated jumps performed while swimming were reinforced. A formal cue was then introduced, and training continued until the cue reliably elicited the complete behavioral sequence.

After the first dolphin had acquired the behavior under cue control, a second dolphin that had not yet been trained to perform the behavior was positioned beside the trained individual.

When the same cue was presented simultaneously to both dolphins, the trained dolphin performed the jump.

At this stage, the second dolphin was not considered to have acquired the specific meaning of the cue. Rather, by following the trained individual and beginning to coordinate its movement with that individual, it produced a broad approximation of the target behavior.

The finer details of the second dolphin's behavior were subsequently shaped individually. At the same time, continued practice alongside the trained dolphin appeared to facilitate acquisition of the behavior.

This case illustrates the imitation- or mirroring-assisted processes described in the preceding section. Specifically, the movement of a trained individual may function as both a behavioral model and a social context that helps elicit an initial approximation from another dolphin.

However, this case should not be interpreted as evidence that the complete trained behavior was acquired through observation or imitation alone.

Rather, imitation- or mirroring-assisted practice appeared to provide an initial behavioral pathway, after which the response was refined through individual shaping, reinforcement, and stabilization under cue control.

This case also illustrates that the same target behavior may be reached through different pathways. Adjustments to the training approach may vary according to individual response patterns and

motivation, while the type and method of reward delivery may also differ among facilities.
This case is therefore intended not to prescribe a standardized procedure, but to illustrate how general learning principles may be adapted to practical circumstances.

Exploration, play-like interaction, and problem solving

In addition to structured training, dolphins may engage in interactions that are not limited to the performance of previously established responses.
In some contexts, dolphins may approach tasks in a more exploratory manner, working through behavioral challenges while maintaining engagement through both successful task resolution and the reinforcement obtained thereafter.
This perspective is consistent with reports that bottlenose dolphins can engage in problem solving with novel interactive apparatuses and may continue participating even when food rewards are not consumed immediately (Lauderdale and Miller, 2019).
In this paper, exploratory interaction refers to situations in which the dolphin is not simply repeating a fixed response, but is given an opportunity to investigate, manipulate, vary, or work through a behavioral or environmental challenge.
Play-like interaction refers to interactions that resemble play in their repetitive, flexible, socially engaged, or apparently self-maintaining characteristics, while recognizing that the underlying motivation cannot always be determined directly.
These terms are therefore used descriptively and cautiously, rather than as evidence that the behavior occurs independently of reinforcement history.
Dolphins may also engage in spontaneous interactions with trainers that resemble play. These may include repeatedly presenting body parts, exchanging objects, or displaying behavior that appears to solicit continued social interaction. For example, outside structured training sessions, a dolphin in an outdoor pool may carry a leaf in its mouth, approach a trainer, and present the object to the trainer, or may approach repeatedly in a manner that appears to invite continued interaction. Although such observations were not collected systematically, they provide practical examples of play-like interaction and social engagement.
Experimental findings showing that dolphins anticipate and participate in familiar human–animal interactions support the possibility that such interactions are positively valued, although responses vary among individuals and situations (Clegg et al., 2018).
Social, exploratory, and task-related features may therefore contribute to continued participation alongside food, conditioned reinforcement, trainer attention, tactile interaction, novelty, and successful problem solving.
The task or interaction itself may contribute to participation, but this should not be interpreted as occurring independently of reinforcement history.

These observations are also relevant to enrichment.

In accredited facilities, training and enrichment are often embedded within the broader management environment rather than functioning as entirely separate domains (Lauderdale et al., 2021a, 2021b). From this perspective, some training tasks may overlap with enrichment-like processes by providing opportunities for exploratory engagement, challenge resolution, behavioral variability, choice, and reward through successful performance.

Reports involving other marine mammal species likewise suggest that play-like tasks and novel learning opportunities may maintain engagement, function in an enrichment-like manner, and contribute to reductions in problematic behavior (Joury et al., 2013).

Taken together, these examples indicate that training can provide structured opportunities for exploration, problem solving, behavioral flexibility, cognitive challenge, and social interaction, and may overlap with welfare-relevant enrichment (Lauderdale et al., 2021a, 2021b).

Multi-individual training and practical complexity

In dolphin training and public presentations, it is common for a single trainer to work with two or more dolphins simultaneously.

Under these conditions, training is shaped not only by cue delivery and reinforcement, but also by learned arrangements concerning spatial order, social relationships among individuals, and the trainer's moment-to-moment decisions.

Research on synchrony in dolphins provides a broader context for considering how coordinated behavior among individuals may influence group-level performance (Fellner et al., 2006). Multi-individual training therefore provides a useful example of how dolphin training occurs within a social and practical context rather than as a simple one-to-one interaction between a trainer and an isolated animal.

The following schematic examples are based on professional dolphin-training practice.Three dolphins may, for instance, be trained to station in the relative order A–B–C. They may be trained to maintain this relative order not only when all three individuals are present, but also when only a subset participates, such as A–C. This positioning may also be generalized across different stationing locations. This may include maintaining the same relative order when stationing at an acrylic viewing panel in front of the audience area (Fig. 2A).

These arrangements suggest that dolphins may learn not only individual stationing responses, but also relative spatial relationships within a group and the positional structure of a trained context. Although these arrangements may support coordinated training and presentations, social interactions among individuals can affect stationing accuracy even when the relative arrangement has been learned.

In another practical situation, threat-related behavior by individual A may cause individuals B and C

to avoid A and move away from their usual stations. Even in such cases, the approximate overall order of the group may be maintained (Fig. 2B). If the individual displaying the displacement behavior subsequently receives additional cues, trainer attention, or reinforcement, moving other dolphins may unintentionally become learned as a means of gaining access to those opportunities. Trainers must therefore observe the posture and behavior of each individual and adjust the distribution of cues and reinforcement so that displacement does not cause the session to progress in a way that favors the individual displaying that behavior. Cue allocation may vary according to the planned behavioral criteria, session structure, individual roles, and physical condition, while avoiding contingencies in which displacing other dolphins provides access to additional opportunities.

Waiting is also a trained component of multi-individual work rather than merely a passive interval. While another individual is performing, a dolphin may be required to remain at its station and maintain attention. Calm stationing itself may also be reinforced.

Periods of activity and waiting may be adjusted according to the physical condition of each individual. For example, for an older dolphin, the amount of physical activity may be adjusted to reduce physical demands, with longer waiting periods or periods of calm stationing provided between more active behaviors. Even when waiting time is increased, however, the trainer must continue to assess whether the individual's attention and willingness to participate are being maintained.

Moreover, in public presentations, repeated use of a highly predictable program may be associated with increasingly routine performance in some individuals.

Some practices therefore introduce variation by alternating the order of the program or adjusting the structure of the session. Such variation should remain compatible with cue clarity, safety, and each individual's learning history.

More broadly, husbandry schedules and the timing of human-controlled events may influence dolphin behavior and willingness to participate (Lauderdale et al., 2021a).

These features highlight the practical complexity of training dolphins as highly social animals.

In multi-individual training, trainers must consider not only the target behavior of each individual, but also spatial order, social relationships, stationing accuracy, waiting, cue allocation, reinforcement timing, individual physical condition, and predictability at the group level.

This complexity is one reason why trained dolphin behaviors should be understood not as simple responses to isolated cues, but as outcomes produced through learning, social interaction, and ongoing trainer judgment.

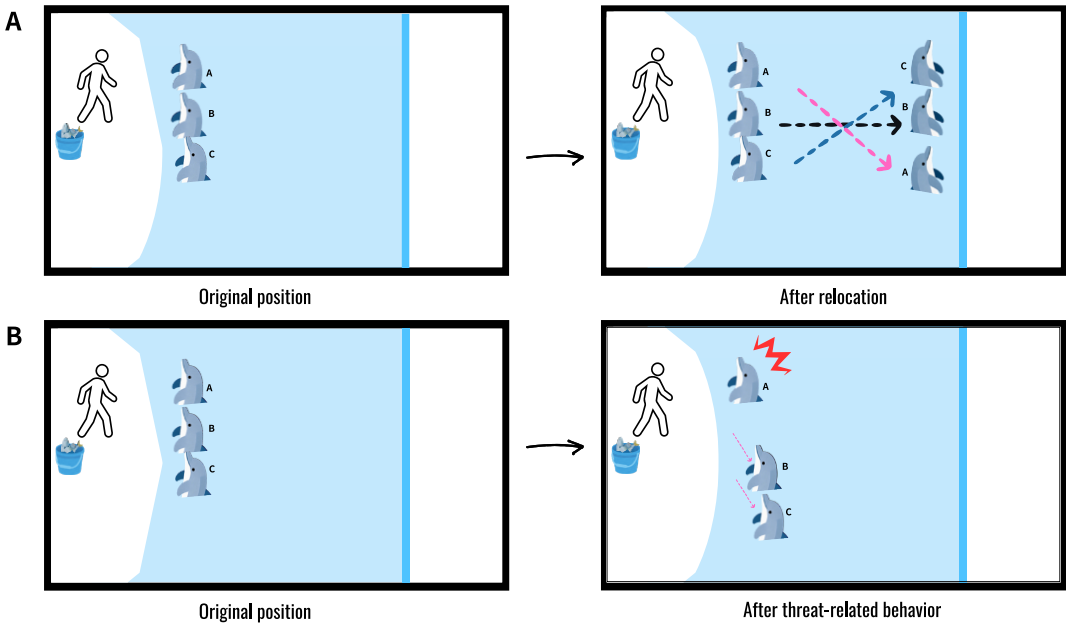

Fig. 2. Schematic illustration of relative spatial organization during multi-individual dolphin training.

(A) Maintenance of the relative A–B–C order after movement to another stationing location. (B) An illustrative situation in which threat-related behavior by individual A causes individuals B and C to move away from their usual stations, while the approximate overall order of the group is maintained.

The diagrams represent illustrative practice-based examples rather than systematically collected observational data.

Welfare-oriented applications: cooperative husbandry training

A major practical application of modern dolphin training is cooperative husbandry, in which animals are trained to participate in medical care, body inspection, health monitoring, and other management procedures (Brando, 2010; Ramirez, 2012).

These behaviors are built through the same principles of reinforcement, shaping, cue control, desensitization, motivational adjustment, and trainer–animal communication, but may require prolonged stationing, immobility, body-part presentation, acceptance of touch, or tolerance of equipment rather than active or play-like responses.

Because husbandry procedures may be uncomfortable, unfamiliar, or relatively inactive, they require careful stepwise training.

The animal may need to learn intermediate behaviors such as remaining still, waiting, allowing contact with specific body parts, accepting equipment, and maintaining engagement during procedural delays; habituation and desensitization may also be required for equipment, touch, and

veterinary stimuli (Brando, 2010; Ramirez, 2012).
When established in advance, these behaviors may reduce reliance on forceful restraint, large-scale handling, or transfer to land.
They may also reduce some of the preparation and handling burden associated with restraint or lifting, making veterinary care and health monitoring more feasible for dolphins and staff.

Cooperative husbandry for veterinary care and health monitoring

Cooperative husbandry training can be applied to a wide range of veterinary, health-monitoring, and management procedures.
In dolphins, these behaviors may include stationing at a specified location, presenting particular body parts, maintaining immobility, accepting touch, tolerating equipment, and remaining engaged for the duration of a procedure.
Such behaviors are especially important because many veterinary procedures require the animal to maintain a stable posture while staff approach, touch, examine, or sample specific body regions.
Blood collection provides a clear example.
A dolphin may first be trained to present and hold the tail fluke in a designated position.
The dolphin can then be gradually habituated and desensitized to repeated tactile stimulation around the vein and to successive steps of the procedure, so that it can eventually remain still while the site is prepared and a needle is inserted.
In this process, reinforcement is not limited to the final blood-collection event, but may also be delivered for intermediate behaviors such as maintaining the fluke position, accepting contact near the vein, remaining still during preparation, or continuing to station during brief procedural delays (Brando, 2010; Ramirez, 2012).
The same principles can be extended to other forms of veterinary care and health monitoring.
Dolphins may be trained to present the mouth, blowhole, pectoral fins, flukes, abdomen, or other body regions for inspection or treatment.
Cooperative stationing and body-part presentation may also support injections, wound inspection, ultrasound examination, body measurements, respiratory sampling, urine or fecal sampling, reproductive sampling, and physiological monitoring.
Reviews of marine mammal training describe cooperative behaviors used to facilitate routine medical procedures (Brando, 2010; Ramirez, 2012).
Veterinary research also provides an empirical example of managed dolphins voluntarily presenting trained body positions for in-water cardiac auscultation and echocardiographic examinations (Linnehan et al., 2020). These applications should not be understood as separate training techniques, but as uses of the same learning processes described earlier: shaping, cue control, reinforcement, habituation, desensitization, and careful adjustment to the animal's responses.

A key feature of cooperative husbandry is that the animal must often maintain participation during procedures that are relatively quiet, repetitive, or physically restrictive.
For this reason, trainers may reinforce not only active responses, but also stillness, waiting, tolerance of touch, and continued engagement.
Importantly, these behaviors are not reinforced only as fixed end-points.
Trainers may observe the animal's moment-to-moment condition and reinforce appropriate intermediate states, such as remaining at station, maintaining immobility, accepting contact, or showing behavior consistent with calm or relaxed participation.
In some cases, reinforcement may be delivered before, during, or after parts of the procedure to support the animal's ability to remain in position and tolerate the required handling.
The timing and form of reinforcement must be adjusted carefully so that the animal's cooperation is maintained without creating confusion about the behavioral criteria.
These applications illustrate how husbandry behaviors are built through ordinary training principles but used in contexts where precision, calmness, duration, and reliability are essential.
By establishing such behaviors before they are urgently needed, routine examinations and clinical procedures can become more feasible and more consistent, while also supporting welfare-oriented care.

Rehabilitation, assistive devices, and long-term care

Cooperative husbandry training may also contribute to rehabilitation and long-term care, particularly when an animal requires repeated therapeutic procedures, physical support, or adaptation to an assistive device.
In such cases, the goal is not merely to complete a single veterinary procedure, but to support the animal's repeated participation in care over an extended period.
This may include accepting contact with injured or sensitive body regions, maintaining a stable posture for assessment or treatment, tolerating assistive equipment, and gradually adapting to changes in movement or body use.
Cases involving artificial tail flukes provide useful examples of this broader application.
Successful rehabilitation of a dolphin that has undergone tail-fluke amputation due to disease requires not only the technical production of a prosthetic device that is gentle on the dolphin's skin and supports its movement, but also gradual familiarization with wearing the device.
To produce a device that is both safe and appropriately fitted to the individual, prototypes with different shapes and materials may need to be tested repeatedly. During fitting, desensitization and habituation conducted by trainers are also essential. The dolphin must gradually become accustomed to the novel object attached to its body, remain still during attachment and removal, accept repeated adjustments, and learn to use its body in ways that allow functional swimming.

From a welfare-oriented perspective, Smooth cooperation during fitting after habituation has progressed does not necessarily mean that the dolphin perceives the device as comfortable or independently chooses to wear it. Such cooperation is supported by gradual habituation, desensitization, shaping, reinforcement, continued adjustment of the device, and trainer responses to behavioral feedback.

These processes may need to continue over an extended period and be adjusted according to the animal's physical condition, behavioral responses, and welfare state.

The case of Fuji, a bottlenose dolphin fitted with artificial tail flukes after severe loss of the tail flukes, illustrates how prosthetic support and rehabilitation can be integrated into long-term care (Ueda et al., 2013).

More recently, the rehabilitation of Sami, an Indo-Pacific bottlenose dolphin that underwent tail-fluke amputation, was evaluated within a welfare-centered framework that included prosthetic-assisted locomotor training and reintegration into a social group (Higa et al., 2026).

Such cases suggest that cooperative training may support not only access to medical procedures, but also the animal's adaptation to altered physical abilities, assistive technology, and changing social conditions.

Rehabilitation and long-term care of this kind illustrate how training, veterinary medicine, behavioral management, and welfare assessment are closely interconnected in modern dolphin care. Although these examples are drawn from managed-care settings, they may also have broader relevance for rescued dolphins or dolphins that cannot be returned to the wild and therefore require prolonged rehabilitation or continuing human care.

Husbandry training cannot be applied immediately to all rescued wild individuals. However, when long-term care is required, the principles of gradual habituation, desensitization, stationing, body-part presentation, and cooperative participation may help inform how physically compromised individuals are assessed, treated, monitored, and supported over time.

Discussion

Reframing dolphin training as a behavioral process

The examples discussed in this paper show that modern dolphin training is best understood through the processes by which visible outcomes are produced.

A jump, coordinated multi-individual performance, blood-collection posture, or cooperation with a supportive device may appear as a single fluent response, yet each is built through behavioral criteria, successive approximations, cue control, reinforcement, motivational adjustment, and trainer judgment.

Operant conditioning remains central, but social context, observational influences, exploration,

voluntary participation, and cooperative engagement shape how these principles are applied.
A process-oriented account therefore avoids interpreting trained responses as either simple obedience or spontaneous expressions of intelligence.
This framing also bridges professional training knowledge and academic description.
Trainers adjust criteria and session structure in response to changes in attention, latency, posture, persistence, social context, and willingness to continue.
Making these decisions explicit allows scientific accounts to address not only what behaviors are performed, but also how they are established, adapted, and maintained.

Training as a context for welfare assessment

Training sessions provide opportunities not only to teach and maintain behaviors, but also to observe the animal's current condition.
Because training involves repeated interactions between the dolphin and trainer, changes in the degree of participation, response latency, attention, accuracy, persistence, stationing, waiting, social interaction, and apparent willingness to continue participating may provide useful behavioral information.
A dolphin that approaches readily, remains engaged, and responds clearly may be in a different state from one that hesitates, disengages, responds more slowly, leaves its station, or repeatedly fails to maintain a familiar behavior.
Such responses should not be interpreted simply as success or failure, but as behavioral feedback whose meaning may differ according to the individual and the training context.
In dolphins under human care, willingness to participate and associated behaviors have been reported to vary according to individual characteristics, time of day, session type, social context, and trainer-related factors (Delfour et al., 2020).
This perspective is particularly important because many welfare-related changes may first appear as subtle behavioral changes during familiar routines.
Trainers who work with individual dolphins over extended periods may notice changes in attention, movement quality, breathing patterns, posture, tolerance of other individuals, or responsiveness before changes in condition become clinically apparent.
In this sense, training may provide a practical context for the early detection of changes in condition, particularly when behavioral observations are shared with veterinarians and integrated with health records or physiological measures. From a health-management perspective, slower responses, reduced movement quality, or behavior that differs from the individual's usual pattern may sometimes precede disease or changes in physical condition.
Empirical evidence showing that reduced willingness to participate may precede identified changes in health status supports this possibility. However, willingness to participate should not be treated as

a stand-alone diagnostic indicator (Clegg et al., 2019).

Public presentations in aquariums are often designed as formats through which visitors can learn in an enjoyable and engaging way.

In this review, Rather than being divided simply into “entertainment” and “education,” such presentations may be understood as behavioral displays that make dolphins’ locomotor abilities, sensory capacities, cognition, social responsiveness, and trainer–animal communication visible to visitors.

When conducted with careful attention to the animals’ condition and behavioral feedback, these contexts may also provide opportunities for physical activity, cognitive engagement, and welfare monitoring.

At the same time, these potential benefits depend on the appropriate management of physical and task demands, motivation, and the animal’s current condition.

Public presentations and training sessions should not place excessive demands on the animal. The frequency, intensity, difficulty, and duration of participation should be adjusted according to behavioral feedback and welfare considerations.

In this respect, the value of training and public presentations lies not simply in whether a behavior is completed, but in whether participation is maintained in a manner that is responsive to the animal’s condition. As a possible future welfare-oriented approach, presentation formats could be considered in which individuals that choose to participate voluntarily move to the main pool at the time of the presentation, thereby giving the animals greater choice over participation itself.

Training-based welfare assessment should therefore focus not only on whether a behavior is performed, but also on how it is performed, under what conditions, and how it changes over time. The quality of participation, the animal’s ability to disengage, the trainer’s response to hesitation or reduced willingness to participate, and adjustments to task difficulty and reinforcement are all important when interpreting welfare.

These observations should be integrated into broader, multidimensional frameworks rather than used as stand-alone indicators (Clegg et al., 2015; Lauderdale et al., 2021a; Baumgartner et al., 2024). Combining behavioral observations with veterinary assessment, physiological monitoring, and longitudinal records may contribute to the development of a more practical and individualized approach to welfare assessment in dolphins under human care.

Limitations and future research directions

This review is a practice-based narrative synthesis and does not test causal relationships among specific training methods, motivation, affective states, or welfare outcomes.

The examples presented here are intended to clarify how field-based practices may be interpreted within the frameworks of learning theory, animal behavior, and welfare-oriented care. They should

therefore be regarded not as conclusive experimental evidence, but as a framework for future investigation.

Several limitations should be considered.

First, dolphin-training practices vary across facilities, trainers, individuals, social groups, reinforcement histories, and husbandry contexts.

A procedure that is effective or appropriate for one individual may not necessarily be suitable for another.

Second, similar behavioral outcomes may arise through different mechanisms.

For example, when the acquisition of a behavior is accelerated after observing another dolphin, the outcome may reflect observational learning, social facilitation, following, synchrony, imitation-like processes, or subsequent shaping by the trainer.

These processes should therefore be distinguished carefully when interpreting practice-based examples.

Third, voluntary participation should be interpreted within the context of learned training practices and should not be treated as evidence that the animal's behavior is independent of its reinforcement history, cueing, trainer–animal relationship, or established session routines.

Future research should determine the extent to which changes in activity and participation during training reflect willingness to participate, affective state, arousal, or stress under different conditions, and examine how these behaviors can be evaluated in relation to welfare. Standardized behavioral and physiological measures should therefore be recorded longitudinally in the same individuals, and changes associated with session conditions, the social environment, and the relationship with the responsible trainer should be compared. Accumulating such evidence may allow training-based indicators to complement broader welfare assessments that include health status and the social environment.

For cooperative husbandry, training procedures should also be improved to reduce the burden and stress associated with procedures and measurements while accounting for individual differences and species-specific characteristics. It is also necessary to verify whether the physiological data obtained appropriately reflect the individual's condition and to develop practical methods that can be applied to a wider range of medical procedures and physiological measurements.

Conclusion

Modern dolphin training should be understood not simply as the production of trained behaviors, but as a behavioral process involving reinforcement, shaping, stimulus control, motivation, social interaction, voluntary participation, and trainer judgment.

From this perspective, performance behaviors, exploratory interactions, multi-individual training, and cooperative husbandry can be understood not as separate techniques or merely practical

procedures, but as interrelated applications of shared learning principles.

Appropriately conducted training may support welfare-oriented care by providing opportunities for physical activity, cognitive engagement, trainer–animal communication, and cooperative participation in health management.

Food is an important primary reinforcer, but praise, tactile interaction such as stroking, and other stimuli may also function as reinforcers. Ideally, willingness to participate should be supported by multiple reinforcers rather than depending solely on food.

At the same time, the performance of trained behaviors alone should not be interpreted as evidence of the animal's willingness to participate or of a good welfare state. When evaluating behavior, it is necessary to consider the individual's learning history and responses, the social context, the possibility of following or behavioral synchrony with other individuals, and the broader conditions under which the behavior occurs and participation is maintained.

By making the processes underlying dolphin training more explicit, this review presents a practice-based framework for describing modern dolphin training within the contexts of learning theory, animal behavior, and welfare-oriented husbandry.

Data availability

No new data were generated or analyzed in this review.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to assist with language editing, organization, and consistency checking.

After using this tool, the authors reviewed and revised the content as necessary and take full responsibility for the content of this article.

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