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BEHAVIOR OF THE PURPLE SHORE CRAB *HEMIGRAPSUS NUDUS* DANA, 1851

Charles A. Jacoby

ABSTRACT

Laboratory and field studies of *Hemigrapsus nudus* reveal that both sexes perform at least 15 social and 12 maintenance behaviors.

Social behaviors are used during defense of food, space, and mates. These aggressive interactions usually begin after contact. Aggression in the laboratory is more variable and involves more contact than confrontations in the field. Pairs of equal-sized *H. nudus* behave more aggressively than pairs of unequal-sized crabs. Males display more behavior resulting in contact than females. Resident crabs defend their space against invasion by nonresident crabs. Nonresidents leave the site of an encounter more frequently than residents.

Brachyuran crabs are excellent subjects for comparative ethological studies. Many species exhibit complex behavioral repertoires (Števčić, 1971) which illustrate adaptive changes associated with the evolution of intertidal and semiterrestrial species from aquatic species and provide information concerning the organization of behavior in an important group of invertebrates.

Previous qualitative investigations of brachyuran crabs have furnished ecological information, descriptions which conveyed general images of behaviors, and preliminary ethological comparisons (e.g., Hiatt, 1948; Bovbjerg, 1960; Griffin, 1965 and 1968; Hughes, 1966; Wright, 1966 and 1968; and Warner, 1970). Some studies detailed a limited number of acts which permitted more extensive comparisons (e.g., Crane, 1943, 1957, and 1966; and Salmon, 1965). Three recent studies by Jachowski (1974), Crane (1975), and Lindberg (1980) reported detailed descriptions for complex behavioral repertoires and provide suitable bases for comparisons. Quantitative data from studies of a few species of brachyurans (e.g., Salmon and Atsaides, 1969; Horch and Salmon, 1969; Hazlett, 1972 and 1976; Hazlett and Estabrook, 1974; Jachowski, 1974; and Hyatt and Salmon, 1979) illustrate the importance of assessing and comparing the effects of various factors, such as size and sex, on frequency of certain acts during interactions.

This study of the behavior of *Hemigrapsus nudus* was designed to produce a detailed ethogram based on laboratory and field studies. These descriptions provided a quantitative basis for investigating the effects of size, sex, and residency on the behavior of adults during interactions.

MATERIALS AND METHODS

Maintenance in the Laboratory

Crabs were kept in 23-l and 45-l aquaria (n ≤ 40 crabs/tank) at Illinois State University, Normal, Illinois. Each aquarium contained water (salinity 35‰), sand, and pieces of flowerpots that provided concealment for the crabs. This arrangement mimicked the natural rocky intertidal habitat of the crabs.

Aquaria were situated on a table under a canvas blind covered with black broadcloth. The light-dark cycle varied seasonally between 14–10 h and 10–14 h with illumination from two 20-W fluorescent bulbs controlled by an electric timer.

Crabs were fed either frozen brine shrimp, frozen pressed shrimp, or lettuce once daily. Water in aquaria was changed after feeding.

Qualitative Analyses

Videotape recordings were made from behind a canvas blind on five days each week from 14 February to 23 April 1975 between 0600 and 0800 hours. Crabs were placed in a 16-l aquarium or a 74-l glass arena equipped with an 8 cm deep reservoir. Water levels in observation containers, numbers of crabs observed together (one to four), and developmental stages (adult male, adult female, juvenile) of crabs observed were varied.

Videotapes were analyzed with the aim of constructing an ethogram. Laboratory studies were augmented by field observations.

A behavior was termed an action pattern and included in the ethogram if it (1) recurred frequently during the study, (2) was performed by many individuals, and (3) varied in form about a typical or modal performance.

Quantitative Analyses

Laboratory Experiments.—Adult crabs with two chelipeds and at least seven walking legs in an intermolt stage were chosen as subjects for quantitative experiments examining factors affecting behavior during interactions. Each specimen was sexed, measured (carapace width ± 1 mm), and numbered on its carapace.

Three sets of experiments were conducted to determine if the frequency of action patterns performed during interactions between pairs of mature *H. nudus* varied as three factors were altered, i.e., relative size, social situation, and residency. In the first set of experiments relative size and social situation were varied. Both crabs were placed simultaneously into a 16-l aquarium filled with seawater. One crab was classified as larger than another if its carapace was 2 mm wider. Social situation was either (1) male with male, (2) male with female, or (3) female with female.

In the second set of experiments the relation between social situation and residency and the frequency of behaviors was explored. Variation in social situation was the same as listed above. One member of each pair of crabs was designated as a resident and was placed in the aquarium first. A crab of the same size (less than 2 mm different in carapace width) was added after 10 min or whenever the resident had occupied a $5 \times 2 \times 1$ cm shelter in the observation container.

A third set of experiments investigated the relation between relative size and residency and the frequency of behaviors. Only males were used in order to eliminate social situation as a variable. Variations in size and residency were identical to those of previous experiments. Ten replicates of each possible combination of factors were performed. The order of the experimental periods and the pairs of crabs observed were randomized. Crabs were used in more than one experimental observation period.

A Datamyte portable data recorder (Electro/General Corporation, Minnetonka, Minnesota) was used to tally the action patterns performed by both crabs. Each behavior was regarded as an event except for "digging" which was treated as a state; i.e., "digging" was counted only once whenever a crab performed repeated leg digs or chela digs (see Table 1) which were not interrupted by a pause or by another behavior. Interactions began whenever crabs were judged to be responding to each other or whenever contact between two crabs was observed. "Leave," not an action pattern, was recorded for the crab that left the site of the confrontation, and this marked the end of an encounter. Each observation period involved at least one interaction.

Field Observations.—Observations of *H. nudus* in its natural habitat were made between 20 June and 12 July 1975. Nine 0.35 m^2 sites on the east coast of San Juan Island, Washington (48°30′N, 123°00′W) were observed. The study areas occurred in three different vertical positions of the intertidal zone and contained rocks (in small, medium, or large densities) which were considered as cover for *H. nudus*. Each site was observed through binoculars for 7 to 8 h per day on two consecutive days, except for the site high in the intertidal zone with a small number of rocks which was observed for only 7 h on one day. Observations were made from areas at least 4 m above and 3 m lateral to the experimental sites so that the crabs were not disturbed.

Whenever an *H. nudus* contacted or appeared to respond to another crab, the following information was recorded: (1) relative sizes of crabs, (2) whether either crab was stationary prior to interaction, (3) all behaviors performed by the crabs in the sequence they occurred, and (4) which crab or crabs moved away from the site of interaction. All observations were spoken into a tape recorder and later transcribed.

Analyses of Data.—Model I 2-way analyses of variance (2-way ANOVAs) were performed on field and laboratory data. The frequency of action patterns performed by interacting crabs in the field was tested for treatment effects of relative size and residency. Relative size, i.e., whether one member of an interacting pair was smaller or larger than the other, was estimated during field observations, and residency was attributed to a crab that was stationary prior to interaction. Residents were typically in crevices although, as in laboratory experiments, they may have been stationary for only a few seconds. Laboratory data from first interactions were examined for significant main and interaction effects of (1) relative size and social situation, (2) social situation and residency, and (3) relative size and residency on the frequency of action patterns performed. If treatment effects were significant ($p \leq 0.05$), multiple comparison tests were conducted with the Tukey Honestly Significant Difference statistic (Kirk, 1968).

The mean number of action patterns performed during an interaction and standard errors were calculated separately for laboratory and field data and compared by Student's t-test.

All action patterns recorded during quantitative field and laboratory observations were tallied in couplets, i.e., a preceding and a following behavior, onto separate contingency matrices. Matrices were designed to represent separately, both within and between individual behavioral transitions. Both precedes-follows contingency matrices were used to construct kinematic graphs. The general theory of this method was discussed by Slater (1973).

Each kinematic graph contains (1) action patterns representing 5% or more of the total number performed by each crab, (2) within and between individual behavioral transitions representing 10% or more of the total number of transitions from each action pattern, and (3) proportions of interactions beginning or ending with an action pattern that were greater than 10% of the total number of interactions observed. If an action pattern was found with no transitions leading to it or away from it, the next most common transitions below the 10% limit are shown. Frequencies of transitions are indicated.

Results

Qualitative Descriptions of Action Patterns

Twenty-seven individual and social action patterns were recognized (Table 1). Behaviors were classified as social action patterns if they were observed only during interactions between crabs. Individual action patterns were more commonly performed by solitary crabs although some were recorded during interactions (Fig. 4). Detailed descriptions of all action patterns are provided by Jacoby (1976).

All action patterns were performed by juveniles, adult males, and adult females. They occurred both under and out of water unless otherwise specified (Table 1). When performing a social action pattern, a crab usually stood with its body 7 to 12 mm above the substratum. The posterior end of the cephalothorax was not raised to the same height as the anterior end due to length and positioning of the third and fourth pairs of walking legs. Positioning of the body during an individual action pattern was more variable.

Types of Interactions

Two types of interactions between mature *H. nudus* were observed in the laboratory and one type was observed in the field. The most common type of encounter noted in the laboratory and the only type seen in the field resulted in one crab leaving the site of the interaction. In the field and in the laboratory these confrontations typically occurred around food or when one crab was in a crevice. This type of encounter occurred frequently enough to describe quantitatively and to analyze statistically the factors affecting interactive behavior.

The second type of interaction was observed only during male-female encounters. The end result of these meetings was the male holding onto the female. These sequences of behavior closely resembled attempted copulation (Knudsen, 1964). However, they were too infrequent to permit quantitative analysis and, therefore, are described elsewhere (Jacoby, 1976).

Table 1. Action patterns performed by *Hemigrapsus nudus*.

Type	Name	Figures	Description
Social	Shield push	1a, b	Chelae held anterior to body with faces perpendicular to substratum; faces of chelae pushed into recipient
	Presentation	1c, d	One cheliped raised lateral to an eye with tip of chela directed anteriorly; held for variable period of time
	Presentation push	1e	Cheliped moved to position of presentation; face of chela pushed into recipient
	Poke	1f	Cheliped extended anteriorly; tip of chela pushed into recipient
	Vertical push	1g	One or both chelipeds raised; dorsal surface(s) of chela(e) pushed into recipient
	Spread	1h, i	Both chelipeds extended laterally; held for variable period of time
	Spread push	1j	Two crabs with chelipeds in positions of spreads face each other; alternate chelae and push laterally
	Spread grasp	1k	Similar to spread push except opponents grasp each other's chelae; often forceful but no injuries observed
	Thrust	2a, b, c	Chelipeds drawn posterolaterally to position like spread then rapidly extended anteriorly; tips of chelae contact recipient; often forceful but no injuries observed
	Jerk	2d, e, f	Chelipeds extended anteriorly to position like end of thrust, then drawn posterolaterally with series of jerks to position like that of spread; produced audible clicks
	Leg pull		Anterior three pairs of walking legs used to pull another crab
	Cheliped push	2g	Medial surface of extended cheliped pushed into recipient
	Walk over		One crab walks over another
	Lift		Walking legs extended rapidly then flexed within one second, which raised then lowered crab's body; typically followed contact with another crab
	Grasp		Variable movements resulting in one crab closing its chela on part of another crab; often forceful but no injuries observed
Individual	Snap back	3a, b	Meropodite of cheliped held lateral to crab's body; chela flexed so it is anterior to body; cheliped moved posteriorly in short, snapping motion then returned; occurred out of water only
	Buccal scrape	3c, d	Tip of chela rubbed against or used to pick at buccal region
	Sternal scrape	3e, f	Dorsal surface of chela rubbed along midline of thoracic sternites; chela may be used to pick at inner surface of abdomen

Table 1. Continued.

Type	Name	Figures	Description
	Cheliped scrape	3g	Chela rubbed or used to pick at contralateral cheliped
	Leg scrape		Walking leg rubbed against ipsilateral walking leg or cheliped
	Eye wipe		Chela or palp of third maxilliped rubbed along ipsilateral eyestalk
	Foam bathing		Bubbles produced near mouthparts and spread over body; fluid from bubbles that burst flowed toward branchial apertures; occurred under water only
	Leg dig		Substratum displaced by movements of walking legs
	Chela dig		Substratum displaced by faces of chelae
	"Aufbäumreflex"		Both chelipeds extended laterally; crab's body elevated on extended walking legs; performed only toward humans
	Flattened	3h, i	Body of crab lowered to substratum, chelipeds folded under anterior of crab, and legs placed flat on substratum
	Abdominal flap		Abdomen extended away from thorax then flexed again; performed during defecation by all crabs, prior to attempted copulation by females and during egg bearing by females

Nonmating Interactions

Quantitative Description.—Over 90% of the nonmating interactions in both the laboratory and the field began only after contact occurred between the two crabs. A significantly larger mean number of action patterns were performed by both crabs during encounters in the laboratory, i.e., 5 ± 0.8 S.E., compared to the field mean of 2 ± 0.1 S.E. (t [df = 425] = 1.95, $p < 0.05$).

Kinematic graphs (Figs. 4 and 5) illustrate the most frequent within and between individual behavioral transitions for 131 interacting pairs of mature *H. nudus*. The kinematic graph representing 91 field interactions (Fig. 4) contains seven action patterns and 19 behavioral transitions and accounts for 87% of the total number of behavioral transitions observed. Laboratory data from 130 interactions subjected to the same analysis yield a kinematic graph (Fig. 5) which contains 13 action patterns and 40 behavioral transitions but accounts for only 49% of the total number of behavioral transitions observed. The crab that initiated an interaction in the laboratory or in the field performed a presentation frequently. Crabs that did not start an interaction often used a walk over and spread. These were the only action patterns observed repeatedly both in the laboratory and in the field.

Factors Affecting Behavior During Nonmating Interactions.—One 2-way ANOVA was performed for each action pattern recorded during the appropriate observation period (n = 59 ANOVAs). Thirteen 2-way ANOVAs indicated sig-

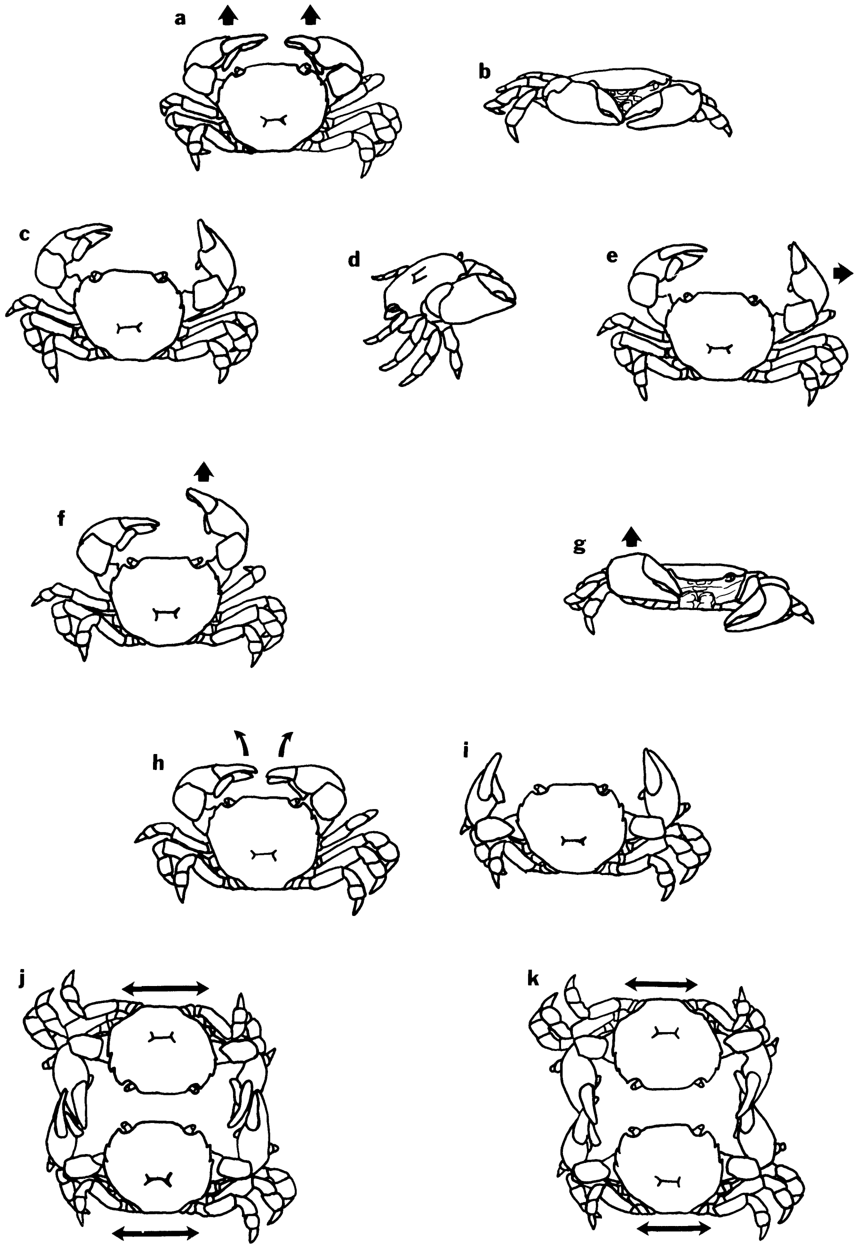

Fig. 1. Social action patterns of *Hemigrapsus nudus*. Arrows indicate direction of movement of chelipeds or whole crabs in j and k. All figures are of adult male crabs. a, shield push, dorsal view; b, chelae held in position for a shield push; chelae would be moved forward from this position to contact a recipient crab, anterior; c, presentation, dorsal; d, presentation, lateral; e, presentation push, dorsal; f, poke, dorsal; g, vertical push, anterior; h, chelipeds in a resting position prior to a spread, dorsal; i, spread, dorsal; j, spread push, dorsal; k, spread grasp, dorsal.

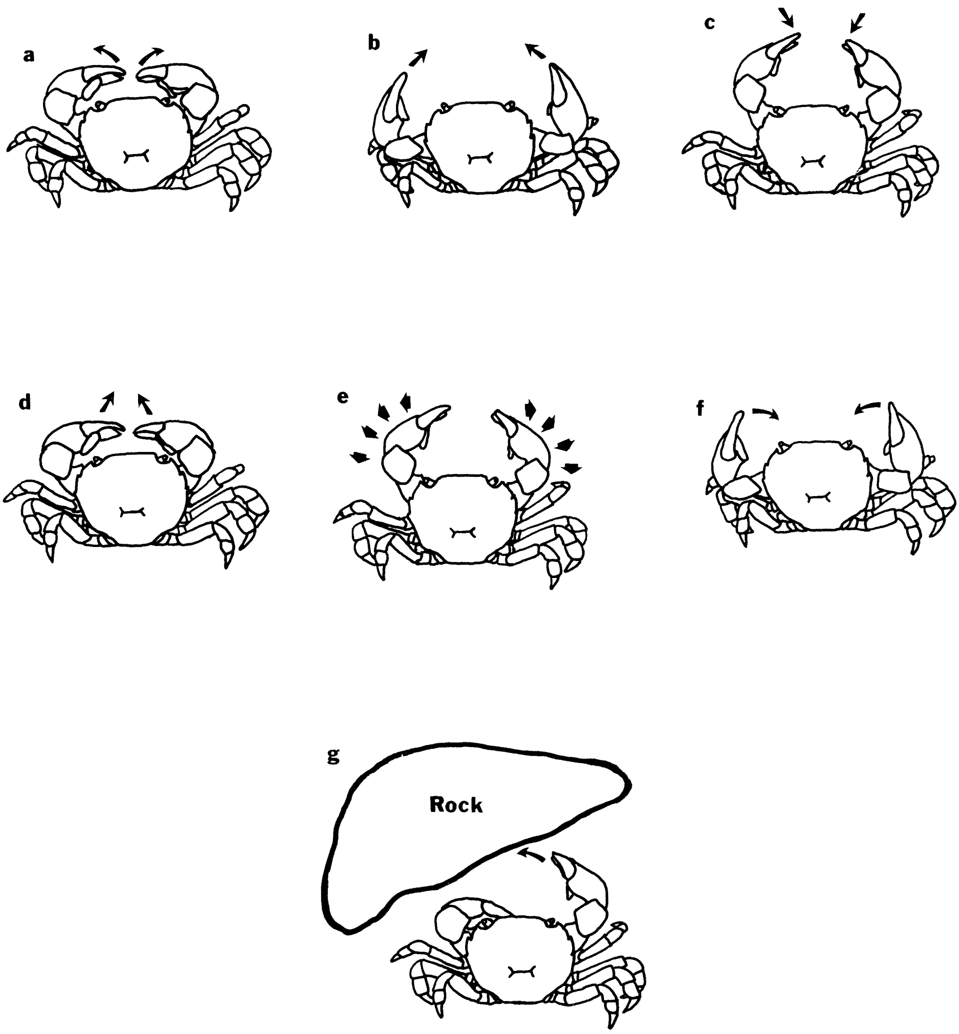

Fig. 2. Social action patterns of *Hemigrapsus nudus*. Arrows indicate direction of movement of chelipeds. All figures are of adult male crabs. a, chelipeds in a resting position prior to beginning a thrust, dorsal view; b, chelipeds at the lateral limit of their motion during a thrust, dorsal; c, chelipeds at the anterior limit of their extension during a thrust, dorsal; d, chelipeds in a resting position before beginning a jerk, dorsal; e, chelipeds at the anterior limit of their extension during a jerk, dorsal; f, chelipeds at the lateral limit of their movement during a jerk, dorsal; g, cheliped push, dorsal.

nificant treatment effects. If a main and an interaction effect were significant in the same ANOVA, only the interaction effect was investigated (Kirk, 1968).

Multiple comparison tests applied to data containing significant main or interaction effects indicated the following patterns: (1) vertical pushes, spreads, walk overs, and shield pushes occurred more often during interactions between equal-sized crabs; (2) leg pulls and shield pushes were observed more frequently during interactions between males of equal size than during male-female encounters or when crabs were of unequal size; (3) in contrast, females performed more lifts

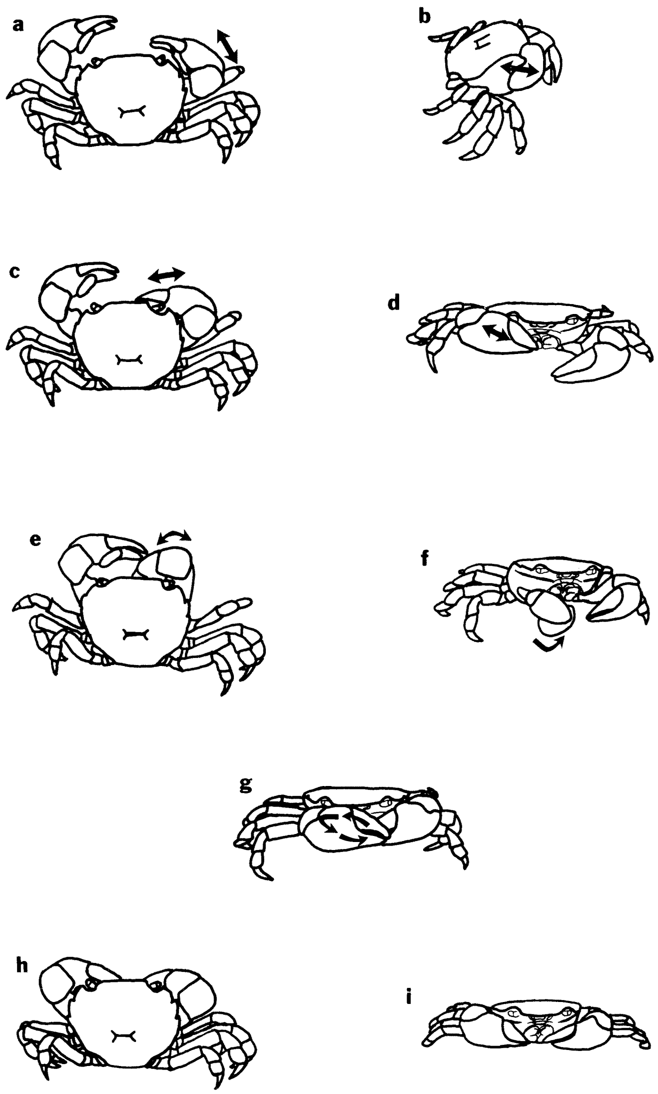

Fig. 3. Individual action patterns of *Hemigrapsus nudus*. Arrows indicate direction of movement of chelipeds. All figures are of adult male crabs. a, snap back, dorsal view; b, snap back, lateral; c, buccal scrape, dorsal; d, buccal scrape, anterior; e, sternal scrape, dorsal; f, sternal scrape, antero-lateral; g, cheliped scrape, anterior; h, flattened, dorsal; i, flattened, anterior.

than males; (4) resident crabs used presentations, spreads, and thrusts more often than nonresidents which utilized more leg pulls and shield pushes; (5) in addition, nonresident crabs executed more "leaves" except in the laboratory when the resident was a smaller crab.

Discussion

Adaptive behavior is crucial to the survival of any animal. *H. nudus,* like other semiterrestrial brachyurans, is exposed to physical and biological factors in the

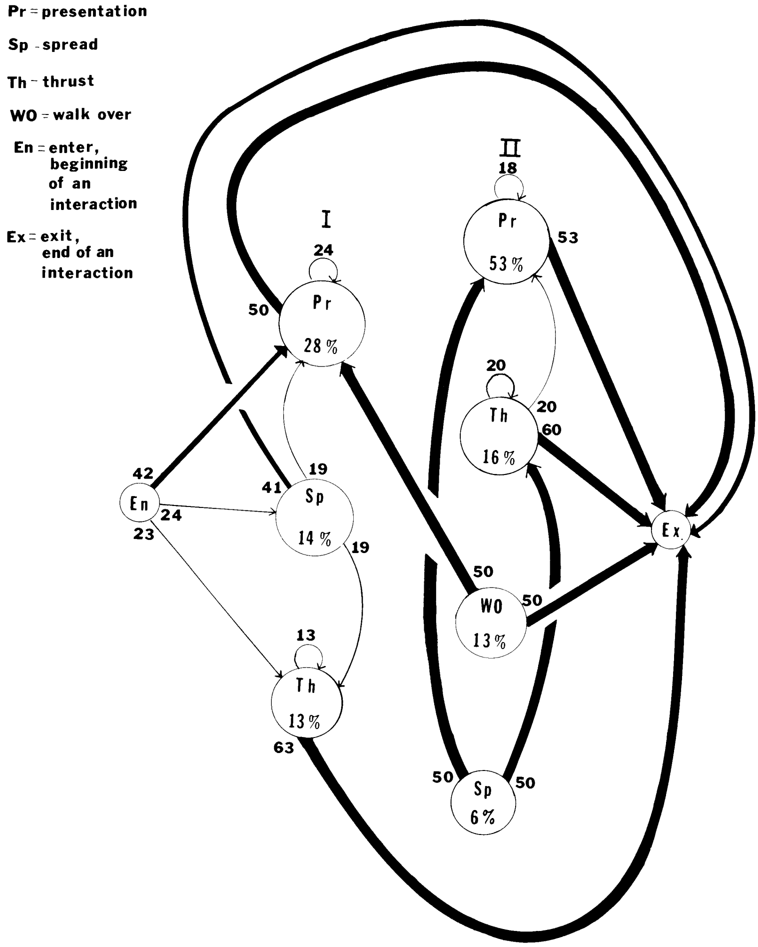

Fig. 4. Kinematic graph constructed from field data. Circles represent behaviors of initiators (crab I) or responders (crab II), and percentages in the circles indicate the percent of the total number of behaviors performed by crabs in that situation. Arrows represent behavioral transitions with wider arrows representing more frequent transitions. Numbers alongside origins of arrows indicate percent of the total number of behavioral transitions from a specific behavior represented by those arrows. Key to abbreviations: En = enter, beginning of an interaction; Pr = presentation; Sp = spread; Th = thrust; WO = walkover; Ex = exit, end of an interaction.

rocky intertidal habitat which shape its ethological as well as its morphological and physiological evolution. The results of this study provide examples of behavioral mechanisms which are important to *H. nudus* during its adult life.

Individual Action Patterns

Individual action patterns of *H. nudus* closely resemble behaviors reported for both aquatic and semiterrestrial species of brachyurans (Wright, 1966 and 1968; and Lindberg, 1980). The similarity of these behaviors among a variety of species is not too surprising, since their main functions, i.e., grooming, providing shelter, and avoiding predation, are required of all crab species. In the repertoire of *H. nudus,* buccal scrapes, sternal scrapes, cheliped scrapes, eye wipes, leg scrapes,

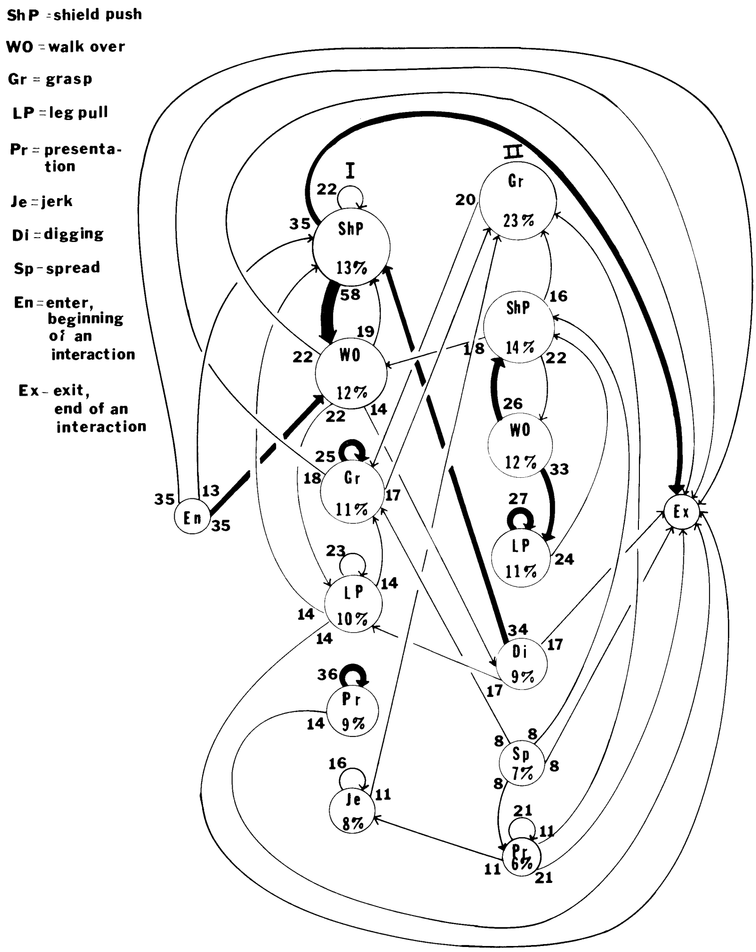

Fig. 5. Kinematic graph constructed from laboratory data. Circles represent behaviors performed by initiators (crab I) or responders (crab II), and percentages in the circles indicate the percent of the total number of behaviors performed by crabs in that situation. Arrows represent behavioral transitions with wider arrows representing more frequent transitions. Numbers alongside origins of arrows indicate the percent of the total number of behavioral transitions from a specific behavior represented by those arrows. Key to abbreviations: En = enter, beginning of an interaction; ShP = shield push; WO = walk over; Gr = grasp; LP = leg pull; Pr = presentation; Je = jerk; Di = digging, leg dig or chela dig; Sp = spread; Ex = exit, end of an interaction.

and abdominal flaps appear to be cleaning behaviors. Abdominal flaps also are used by females to aerate and flush egg masses, and were observed to be associated with stimulation of attempted copulation. Foam bathing may cleanse the body surface and aerate water reserves. Snap backs should circulate water in the gill chambers and assist in gas exchange. Digging with the chelae or walking legs produces shelter from desiccation and predators. The action pattern termed flattened makes *H. nudus* less conspicuous in its natural environment; this is useful in predator avoidance. "Aufbäumreflex" (term coined by Bethe, 1897, cited in Hiatt, 1948) was observed as a response to approach by a human or inanimate object, not an approaching crab. In this position, the crab has its chelae directed upward toward a larger predator (Robinson *et al.,* 1970). Therefore, I believe "Aufbäumreflex" is a behavior to deter predators and not an interspecific aggressive behavior as suggested by Jensen (1972) whose interpretations are based mainly on encounters between crabs and inanimate models.

Social Action Patterns

The behavioral repertoire of *H. nudus* contains action patterns which are performed during interactions between conspecifics. Nonmating interactions begin when one crab is approached by another and end with one crab moving away. Most encounters occur near a crevice or other shelter, food, or a mate. When performing social action patterns, crabs generally elevate their bodies above the substratum and thereby become more conspicuous. Certain action patterns accentuate the size of a crab or emphasize the noncryptic faces of the chelae by extension of the chelipeds, i.e., spread and presentation, or elevation of the body, e.g., walk overs and lifts. A jerk may emphasize the chelipeds and chelae both by their dynamic movement and the sound produced. Other action patterns, e.g., shield push, thrust, spread push, spread grasp, leg pull, involve forceful contact without injury and may be tests of strength. The form of social action patterns and their use closely resemble aggressive behavior in other brachyurans (see Hughes, 1966; Wright, 1966 and 1968; Salmon, 1965 and 1967; Schöne, 1968; Horch and Salmon, 1969; Warner, 1970; Hazlett, 1972 and 1976; Hazlett and Estabrook, 1974; Jachowski, 1974; Crane, 1975; Evans *et al.,* 1976; Lindberg, 1980; and Vannini, 1980). Therefore, these behaviors are classified as aggressive action patterns.

Schöne (1968) proposed that aquatic crabs would display more behavior involving contact than semiterrestrial species which would rely on optical information. *H. nudus* uses both types of aggressive behavior. However, the action patterns of *H. nudus* that include contact are controlled and do not result in injuries. Aggression in *H. nudus* does not resemble the "wild fights" of some aquatic species (Schöne, 1968).

Aggressive Interactions

Aggressive behavior for *H. nudus* in the field is qualitatively similar to aggression in the laboratory. Action patterns do not differ in form. Interactions typically begin after contact between crabs indicating that a crab is defending a small area around itself. Defense of a small personal space correlates with the tendency for *H. nudus* to aggregate under rocks. Aggression mainly occurs near shelter, food, or a mate. Defense of each of these has obvious adaptive advantages.

Quantitative analyses reveal that crabs performed more action patterns per encounter in the laboratory than in the field. Furthermore, a kinematic graph constructed from laboratory data contains approximately twice as many action patterns and behavioral transitions as a similar graph for field data, and yet it represents about half as much of the total observed behavior. This indicates a greater amount of variability during laboratory observations. Contact action patterns, e.g., shield push, grasp, and leg pull, were performed more frequently in the laboratory than in the field. The increase in encounter length, repertoire variability, and use of contact action patterns may be due to the presence of water only during laboratory observations. Crabs in the field were not visible during high tides. Bovbjerg (1960) reported that *Pachygrapsus crassipes* interacts more frequently and with "strong aggressive tendencies" under water. Alternatively, confinement may lead to stress and increased aggression. Since the densities of crabs in the laboratory aquaria were similar to field densities, crowding should not be a major factor. The differences between laboratory and field data will not affect results of 2-way ANOVAs because these tests were performed without comparing laboratory behavior to field behavior; they do indicate that caution should be taken when generalizing from laboratory observations that are not supported by field work.

Significant treatment effects of size in 2-way ANOVAs indicate that equal-sized pairs of *H. nudus* perform certain aggressive action patterns more frequently than pairs of unequal size. Because equal and unequal-sized pairs of crabs execute other behaviors with similar frequency, these results support the hypothesis that equal-sized pairs of crabs are more active during encounters. The same supposition was drawn from qualitative data by Hiatt (1948) for *Pachygrapsus crassipes,* Hughes (1966) for *Heloecius cordiformis* and *Hemiplax latifrons,* and Wright (1966) for several semiterrestrial species of crabs.

Significant interaction effects between social situation and size show that males and pairs of equal-sized crabs perform more contact action patterns, i.e., leg pulls and shield pushes, than females and unequal-sized pairs. The effect of size is discussed above. Male *H. nudus* apparently execute more contact action patterns than females. A similar conclusion was drawn by Jachowski (1974) from quantitative experiments with *Callinectes sapidus.* In contrast, females use more lifts than males. Perhaps this is because a lift usually is a response of the recipient of a contact action pattern. Males perform more contact action patterns; therefore females respond with more lifts.

Resident crabs perform more action patterns that would deter an invading crab, i.e., presentations, spreads, and thrusts, than nonresident crabs. Nonresident crabs display more behaviors that would pull or push a resident crab out of a crevice, i.e., leg pull or shield push. The tendencies for resident crabs to maintain their positions and for nonresident crabs to try to displace them were also reported for *Uca pugilator* and *Uca pugnax* by Hyatt and Salmon (1979).

Results of 2-way ANOVAs indicate that residency is the most important factor in determining the "winner" of an encounter. Unlike studies involving territorial animals, my criterion for residency did not require more than a few seconds of habitation in an area. *H. nudus* typically moved freely in the intertidal zone and entered many crevices. There was no evidence of return to a given area or establishment of a territory. Regardless of the brevity of residency prior to an interaction, residents performed fewer "leaves" in all situations, except in the laboratory when the resident was smaller than the nonresident. This result may be due to the fixed size of the shelter in the laboratory, which may have been too large for small crabs. Other explanations could be that the crab was not a resident for a sufficient length of time and consequently did not defend the shelter vigorously or that the larger nonresident was more persistent in its attempts to secure shelter on account of laboratory confinement. Griffin (1965 and 1968) reported qualitative assessments which agree with my overall results. However, my results do not indicate a consistent relationship between defense of an area and size or social situation. These results do not agree with previous investigations (e.g., Bovbjerg, 1960; Griffin, 1965 and 1968; Hughes, 1966; Wright, 1966; Warner, 1970; and Hazlett and Estabrook, 1974) which suggest that larger crabs and males should be dominant to smaller crabs and females.

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ANNOUNCEMENT

A symposium on "The Biology of the Antarctic Krill *Euphausia superba*: Life History Strategies, Larval Morphology, Distribution Patterns, and Physiological Adaptations", will be held in June 1982 at the Institute of Marine Biomedical Research, University of North Carolina at Wilmington, Wilmington, North Carolina, 28403. Further information may be obtained by writing Dr. Robert Y. George at that address [(919) 256-3721].