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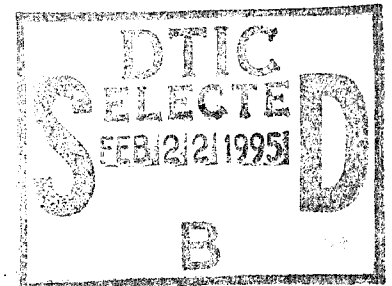
PHYSICAL TRAINING ACTIVITIES OF EAST COAST

U.S. NAVY SEALS

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NAVAL MEDICAL RESEARCH AND DEVELOPMENT COMMAND
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**Physical Training Activities of East Coast
U.S. Navy SEALs**

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SUMMARY

Problem.

U.S. Navy Sea-Air-Land (SEAL) personnel often conduct physically demanding missions under highly stressful conditions. The missions, conducted in both terrestrial and maritime environments, frequently require high levels of both aerobic (muscular and cardiorespiratory endurance) and anaerobic (muscular strength and power) fitness. SEALs must maintain fitness while undergoing extensive operational training that may limit the availability of physical training time.

Objective.

This survey was conducted to document the aerobic, strength, and overall conditioning programs of Navy SEALs on the East Coast and to serve as a baseline for future studies evaluating the effectiveness of self-selected training programs in maintaining physical fitness. A study on SEALs assigned to West Coast commands has been reported previously by Prusaczyk, Goforth, and Nelson (1990).

Approach.

A detailed physical training activity questionnaire was administered to 75 East Coast U.S. Navy Sea-Air-Land (SEAL) personnel undergoing advanced training. Questions were designed to document the mode (type), duration, frequency, and intensity of exercise and the locations/facilities where the SEALs engaged in regular physical fitness training. The training activities were evaluated according to the American College of Sports Medicine guidelines for developing and maintaining aerobic and strength fitness.

Results.

Overall, these East Coast SEALs reported engaging in aerobic activities (running, swimming, bicycling) at frequencies, intensities, and durations adequate for maintaining aerobic fitness levels. Strength conditioning was also determined to be of sufficient volume to maintain current levels of muscular strength.

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Conclusions.

Although East Coast SEALs engage in physical training activities with sufficient volume and intensity to maintain current levels of physical fitness, there is evidence that SEALs can significantly improve both aerobic and anaerobic fitness with only 90 additional minutes of training per week (Jacobs, Prusaczyk, & Goforth, 1994). The effectiveness of the current training programs should be evaluated to ensure SEALs' ability to meet the most physically demanding tasks they may be required to perform (Stuster, Goforth, Prusaczyk & Meyer, 1994). Additionally, these data will serve as baseline data in other studies evaluating physical training programs for SEALs and to assist in the development of guidelines for avoiding detraining under conditions where appropriate equipment and training opportunities are limited (e.g., shipboard and submarine deployments).

INTRODUCTION

U.S. Navy Sea-Air-Land (SEAL) personnel often conduct physically demanding missions under highly stressful conditions (Stuster, Goforth, Prusaczyk, & Meyer, 1994). The missions, conducted in terrestrial and maritime environments, frequently require high levels of both aerobic (muscular and cardiorespiratory endurance) and anaerobic (muscular strength and power) fitness. In fact, it has been suggested that SEALs rely on their physical fitness more than any other U.S. military component (Barnes & Strauss, 1986). Because of the physical demands of their missions, SEALs are required to maintain higher fitness standards than other Navy personnel (BUPERS Manual 1410-380).

Physical fitness levels and anthropometric profiles of SEALs and Basic Underwater Demolition/SEAL (BUD/S) students have been documented previously (Beckett, Goforth, & Hodgdon, 1989). These data showed that BUD/S students and platoon SEALs have relatively high aerobic fitness, with mean peak oxygen uptakes ($\dot{V}O_{2peak}$) of $62.4 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ and $57.7 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, respectively. SEALs also have a high mesomorphic (i.e., muscularity) component (5.8 ± 0.9) on the Heath-Carter somatotype scale (Carter, 1980). Interestingly, mesomorphy scores for BUD/S students graduating in 1989 (5.8 ± 0.8 ; Beckett et al., 1989) were not different from those graduating in 1973 (5.9 ± 1.5 ; Carter & Rahe, 1973).

Maximal aerobic power, measured as $\dot{V}O_{2peak}$, is a laboratory measure used to evaluate maximal energy output by aerobic processes (Åstrand & Rodahl, 1977) and is an indicator of the ability to perform endurance activities. While it has been suggested that U.S. Army Special Forces (SF) soldiers have the highest aerobic power of any U.S. military population (Muza, et al., 1987), Beckett and colleagues (1989) documented a mean $\dot{V}O_{2peak}$ for SEALs that was more than 6% higher than Army SF personnel. Although the $\dot{V}O_{2peak}$ of these platoon SEALs was higher than the Army SF, it was significantly lower (8%) than recent BUD/S graduates. The decrement in $\dot{V}O_{2peak}$ cannot be ascribed solely to the age difference (22 ± 2 yr for BUD/S and 26 ± 4 yr for SEALs). Instead, the decrease may reflect reduced physical training volume or intensity and a shift toward increased operational readiness training.

To maintain the levels of aerobic and anaerobic fitness required for full mission capability, SEALs perform regular physical training with their platoons or detachments. In addition, most

SEALs engage in other physical training activities (Barnes & Strauss, 1986). These activities include individual physical training, skilled activities, and team sports. Analysis of SEALs' physical training activities could provide basic information on the effectiveness of the overall training program for maintaining mission-related fitness. The mission of SEALs on the two coasts is often viewed as somewhat different (Stuster, Goforth, & Prusaczyk, 1993; Stuster, et al., 1994); therefore, documentation of the physical training activities of SEALs from the two coasts was undertaken. Data on the physical training activities of SEALs from West Coast commands (SEAL Teams One, Three, and Five and SDV Team One) has been reported previously by Prusaczyk, Goforth, and Nelson (1990). This survey was conducted to document the aerobic and strength conditioning programs of East Coast U.S. Navy SEALs and to evaluate the effectiveness of the self-selected training programs in maintaining physical fitness.

MATERIALS AND METHODS

Physical activity questionnaires (Appendix A) were distributed to East Coast SEALs undergoing advanced operational training. The SEALs were involved with one of eleven different courses or activities: 1) Combat Swimmer, 2) Land Warfare, 3) Maritime Operations, 4) Cold Weather Training, 5) Classroom Preparation, 6) Stand-Down Preparation, 7) Mission Preparation, 8) Exercises, 9) Field Activities, 10) Core Training, or 11) Advanced SDV Training. The questionnaires were used to collect data on the characteristics of SEALs' physical training activities, including the type of fitness activities (i.e., aerobic, anaerobic, skill/sport, etc.); frequency, duration, and intensity of participation; and the locations and conditions of training. Descriptive statistics were computed for each question using SPSS-X Release 3.1 for VAX/VMS on the Naval Health Research Center's VAX 6000, Model 310 computer.

RESULTS

Physical Training Activities.

A total of 75 questionnaires were completed and returned from the East Coast SEALs. The data in the tables below are based on the responses provided by the SEALs. The statistics are based on the total number of individuals responding on each question. The number of SEALs engaging in individual physical conditioning activities and the mean frequencies with which they engaged in the activities are presented in Table 1.

Table 1. Frequency of participation (times per week) in fitness activities during advanced training.

ACTIVITY	N	% N	MEAN	SD
Running	74	99	4.0	1.3
Swimming	72	96	1.8	1.2
Calisthenics	68	91	4.0	1.4
Obstacle Course	67	89	1.6	1.2
SCUBA/Snorkel	65	87	1.4	1.1
Weight Training	62	83	2.9	1.6
Bicycling	46	61	2.5	1.7
Walking	17	23	3.8	2.7
Rowing	16	21	1.8	1.6
Aerobics Class	8	11	2.8	2.0

Legend: ACTIVITY is the type of exercise in which SEALs engaged.
 N is the number of SEALs engaging in the activity.
 % N is the percent of 75 SEALs who reported engaging in the activity.
 MEAN is the arithmetic mean of the responses.
 SD is the standard deviation about the mean.

The number of SEALs reporting participation in skill or team sport activities and the frequency with which they participated are summarized in Table 2.

Table 2. Frequency of participation (times per week) in skill, team, and other activities during advanced training.

ACTIVITY	N	% N	MEAN	SD
Volleyball	31	41	1.4	1.2
Racket Sports/Handball	23	31	1.5	1.5
Baseball/Softball	22	29	1.8	1.6
Basketball	21	28	2.2	1.8
Football	19	25	1.4	1.4
Martial Arts	15	20	2.8	1.8
Boxing/Wrestling	12	16	1.8	1.8
Other	6	8	2.8	2.1

Legend for Table 2 is the same as for Table 1. [The data presented reflect the mean responses of those providing the information.]

The characteristics of running, the most frequently employed method of aerobic training, are summarized in Table 3. This table outlines frequency, duration, volume, and intensity of running. To determine total running time per week, the product of frequency (4.1 times per week) and duration (46.1 min per run) was calculated. The mean frequency-duration product was 189 minutes of running per week.

Only 17% of SEAL respondents reported running while carrying a load (e.g., backpack), while 20% reported load carriage while walking. The mean (\pm SD) pace in minutes per mile was 9.9 min (\pm 1.2 min) for running and 17.4 min (\pm 12.7 min) for walking.

Table 3. Characteristics of running as a physical training activity among East Coast SEALs.

ATTRIBUTE	N	% N	MEAN	SD
Frequency (times per week)	38	51	4.1	1.0
Duration (minutes per run)	38	51	46.1	26.3
Intensity (minutes per mile)	39	53	7.5	0.7
Volume (miles per week)	37	50	20.5	8.3

Legend: ATTRIBUTE is the characteristic of running described.

N is the total number of SEALs reporting on the attribute.

% N is the percent of SEALs reporting on the attribute as a percent of those reporting engaging in the activity (Table 1).

MEAN is the arithmetic mean of responses for the attribute.

SD is the standard deviation about the mean.

Table 4 summarizes the frequency with which SEALs train on various surfaces (running), locations and equipment used for aquatic activities (swim/scuba/snorkel), and equipment used (bicycle and rowing machines). Table 5 summarizes the frequency with which SEALs use various training surfaces for skill and team sport activities.

Table 4. Frequency of use (times per week) of various physical training surfaces, locations, and equipment for aerobic activities.

ACTIVITY	LOCATION/SURFACE	N	% N	MEAN	SD
Running					
	Sand	71	96	2.0	1.2
	Dirt	66	89	2.5	1.4
	Grass	57	77	2.7	1.6
	Asphalt	72	97	3.1	1.4
	Concrete	54	73	2.6	1.6
	Track	11	15	1.6	1.5
SCUBA/Snorkel					
	Pool	28	43	1.1	0.6
	Ocean	64	98	1.3	0.8
	with Fins	62	97	1.4	1.0
	without Fins	17	27	1.4	0.8
Swimming					
	Pool	51	71	1.5	1.0
	Ocean	68	94	1.3	0.6
	with Fins	64	89	1.4	0.9
	without Fins	39	54	1.6	1.0
Bicycling					
	Road	42	91	2.3	1.5
	Stationary	15	33	1.7	1.2
Rowing					
	Boat	10	63	1.1	0.3
	Machine	11	69	1.4	0.8

Legend for Table 4 is the same as for Table 1.

Table 5. Frequency of use (times per week) of physical training surfaces for skill and team sport activities.

ACTIVITY	SURFACE	N	% N	MEAN	SD
Racquet Sports/Handball					
	Wood	18	78	1.1	0.2
	Asphalt	5	22	1.0	0.0
	Concrete	10	45	1.0	0.0
Basketball					
	Wood	15	71	1.6	1.0
	Asphalt	10	48	1.4	0.8
	Concrete	12	57	1.3	1.3
Volleyball					
	Sand	29	94	1.4	1.0
	Grass	13	42	1.0	0.0
	Wood	9	29	1.1	0.3
	Asphalt	3	10	1.0	0.0
	Concrete	4	13	1.0	0.0

Legend for Table 5 is the same as for Table 1 with the addition of surface upon which the activity was performed.

Eighty-three percent of the SEALs reported engaging in weight training as an activity. Overall, weight training focused on upper body exercises. Detailed descriptions of the number of sets performed, number of repetitions per set, weights used, duration of exercise, perceived effort, and the one-repetition maximal (1-RM) weight lifted are presented in Table 6. Weight training sessions lasted an average of 59 ± 15 minutes (Table 7).

Tables 7 and 8 summarize the mean frequency, duration, and perceived intensity of SEALs' participation in each of the individual physical training activities and in the skill and team sports, respectively.

Table 6. Characteristics of East Coast SEALs' weight training exercise.

Number of Sets				
EXERCISE	N	MEAN	SD	RANGE*
UPPER BODY EXERCISES				
Neck	16	3.4	1.7	1-9
Upright Rowing	27	3.7	1.5	1-9
Bent Rowing	23	4.0	1.6	1-9
Bench Press	43	4.5	1.8	1-9
Military Press	32	4.0	1.4	1-9
Incline Press	35	4.2	1.7	1-9
Biceps Curl	43	4.2	1.9	1-9
Triceps Curl	39	4.0	1.7	1-9
Latissimus Pull	16	4.1	1.6	1-9
Wrist Curl	19	3.8	1.2	1-6
Sit-up	15	4.1	2.1	2-9
LOWER BODY EXERCISES				
Leg Press	15	1.1	0.5	1-3
Squat	15	3.9	1.4	1-6
Leg Curl	16	3.3	1.3	1-6
Toe Raises	16	3.5	1.3	1-9
Leg Extension	15	3.4	1.1	1-6
Stair Climb	4	3.3	0.5	3-4
OTHER EXERCISES				
Other	5	5.2	2.3	3-9

*Range is range of response values reported.

Table 6. Characteristics of East Coast SEALs' weight training exercise (continued).

Repetitions per Set				
EXERCISE	N	MEAN	SD	RANGE
UPPER BODY EXERCISES				
Neck	15	11.6	6.5	3-30
Upright Rowing	27	10.0	1.9	4-13
Bent Rowing	23	10.2	1.3	6-13
Bench Press	43	10.0	2.7	1-20
Military Press	32	10.1	1.7	4-13
Incline Press	35	9.8	1.7	4-13
Biceps Curl	43	10.7	2.9	4-20
Triceps Curl	40	10.6	2.6	4-20
Latissimus Pull	35	10.4	2.8	4-20
Wrist Curl	19	12.4	4.9	9-30
Sit-up	13	37.5	31.7	10-99
LOWER BODY EXERCISES				
Leg Press	15	11.7	5.1	10-30
Squat	15	7.3	1.8	5-10
Leg Curl	17	10.9	2.5	10-20
Toe Raises	15	15.2	7.1	10-30
Leg Extension	15	10.5	0.9	10-13
Stair Climb	5	13.6	6.4	10-25
OTHER EXERCISES				
Other	5	11.8	4.7	8-20

Table 6. Characteristics of East Coast SEALs' weight training exercise (continued).

Duration (minutes)*				
EXERCISE	N	MEAN	SD	RANGE
UPPER BODY EXERCISES				
Neck	10	13.3	16.9	1-60
Upright Rowing	21	15.9	20.6	1-90
Bent Rowing	16	18.9	23.0	1-90
Bench Press	30	16.8	17.6	1-90
Military Press	24	16.2	19.2	1-90
Incline Press	25	16.6	18.7	1-90
Biceps Curl	29	15.9	18.0	1-90
Triceps Curl	28	15.3	18.0	1-90
Latissimus Pull	25	15.8	26.9	1-90
Wrist Curl	13	19.6	25.8	1-90
Sit-up	8	15.4	12.6	5-45
LOWER BODY EXERCISES				
Leg Press	11	21.1	28.0	1-90
Squat	12	22.5	26.5	1-90
Leg Curl	12	19.8	27.1	1-90
Toe Raises	14	15.1	22.3	1-90
Leg Extension	12	20.0	26.9	1-90
Stair Climb	2	5.0	0.0	5- 5
OTHER EXERCISES				
Other	5	8.6	3.0	5-12

* Duration (minutes): 0-(none); 1-(<11); 2-(11-20); 3-(21-30); 4-(31-40); 5-(41-50); 6-(51-60); 7-((61-119); 8-(120-180); 9-(> 180)

Table 6. Characteristics of East Coast SEALs' weight training exercise (continued).

Weight used (pounds)

EXERCISE	N	MEAN	SD	RANGE
UPPER BODY EXERCISES				
Neck	10	33.0	22.1	5- 90
Upright Rowing	25	89.0	38.3	20-180
Bent Rowing	20	122.1	57.1	25-190
Bench Press	40	184.6	46.0	100-280
Military Press	28	112.8	38.4	30-180
Incline Press	31	131.3	43.8	50-225
Biceps Curl	39	64.5	23.0	25-110
Triceps Curl	35	62.3	30.0	15-170
Latissimus Pull	31	144.5	53.8	50-220
Wrist Curl	15	48.3	24.7	15-100
Sit-up	5	53.0	85.2	10-205
LOWER BODY EXERCISES				
Leg Press	12	123.8	53.8	40-200
Squat	13	203.3	82.8	80-350
Leg Curl	14	74.6	31.2	40-150
Toe Raises	11	134.1	67.2	10-220
Leg Extension	12	123.8	53.8	40-200
Stair Climb	2	75.0	35.4	50-100
OTHER EXERCISES				
Other	4	103.8	64.2	35-190

Table 6. Characteristics of East Coast SEALs' weight training exercise (continued).

One-repetition maximum (pounds)

EXERCISE	N	MEAN	SD	RANGE
UPPER BODY EXERCISES				
Neck	6	35	18.7	5- 60
Upright Rowing	18	128	53.8	35-245
Bent Rowing	13	153	64.9	35-225
Bench Press	28	243	66.2	10-365
Military Press	21	154	47.2	90-285
Incline Press	23	175	61.6	65-275
Biceps Curl	26	88	40.5	20-180
Triceps Curl	26	79	40.8	15-190
Latissimus Pull	21	164	49.5	15-250
Wrist Curl	9	67	39.9	20-130
Sit-up	4	69	37.5	25-100
LOWER BODY EXERCISES				
Leg Press	8	351	123.9	200-500
Squat	9	283	91.2	160-400
Leg Curl	8	104	47.8	40-180
Toe Raises	5	201	118.7	40-375
Leg Extension	8	166	45.0	65-200
Stair Climb	1	59	---	---
OTHER EXERCISES				
Other	2	40	35.4	15- 65

Table 6. Characteristics of East Coast SEALs' weight training exercise (continued).

Perceived Effort*

EXERCISE	N	MEAN	SD	RANGE
UPPER BODY EXERCISES				
Neck	14	5.7	1.8	4-10
Upright Rowing	27	7.2	1.8	4-10
Bent Rowing	22	6.7	1.9	4-10
Bench Press	43	7.2	1.9	3-10
Military Press	32	7.3	1.6	4-10
Incline Press	35	7.4	1.7	4-10
Biceps Curl	42	7.3	1.9	3-10
Triceps Curl	39	7.4	1.8	3-10
Latissimus Pull	36	7.2	1.9	5-10
Wrist Curl	21	7.1	1.9	4-10
Sit-up	14	7.3	2.2	4-10
LOWER BODY EXERCISES				
Leg Press	15	6.7	1.5	5-10
Squat	15	7.3	1.9	5-10
Leg Curl	17	6.8	2.0	4-10
Toe Raises	15	6.7	1.9	4-10
Leg Extension	17	6.9	1.9	5-10
Stair Climb	2	6.5	2.1	5- 8
OTHER EXERCISES				
Other	6	6.8	2.0	4-10

* Perceived intensity scale: 1-very easy; 2-easy; 3-; 4-moderately difficult; 5-; 6-difficult; 7-; 8-intense; 9-; 10-very intense

Table 7. Summary of the characteristics of physical training activities of East Coast SEALs ordered by number of participants.

ACTIVITY	ATTRIBUTE	N	% N	MEAN	SD
Running					
	Frequency	74	99	4.0	1.3
	Intensity	61	81	6.1	2.0
	Duration	73	97	4.6	1.3
Swimming					
	Frequency	72	95	1.8	1.2
	Intensity	59	79	5.3	2.1
	Duration	71	95	4.9	1.6
Calisthenics					
	Frequency	68	91	4.0	1.4
	Intensity	57	76	6.8	2.0
	Duration	70	93	5.5	1.4
Obstacle Course					
	Frequency	67	89	1.6	1.2
	Intensity	54	72	6.9	2.1
	Duration	--	--	---	---
SCUBA/Snorkel					
	Frequency	65	87	1.4	1.1
	Intensity	52	69	4.8	2.3
	Duration	65	87	5.6	1.9

Scales key

- Frequency: 0-(never); 1-(> 0 & $\leq 1x/wk$); 2-($2x/wk$); 3-($3x/wk$); 4-($4x/wk$); 5-($5x/wk$); 6-($6x/wk$); 7-($\geq 7x/wk$)
- Intensity: 1-very easy; 2-easy; 3-; 4-moderately difficult;5-; 6-difficult; 7-; 8-intense; 9-; 10-very intense
- Duration (minutes): 0-(N/A); 1-(< 11); 2-(11-20); 3-(21-30); 4-(31-40); 5-(41-50); 6-(51-60); 7-((61-119); 8-(120-180); 9-(> 180)

Table 7. Summary of the characteristics of physical training activities of East Coast SEALs ordered by number of participants (continued).

ACTIVITY	ATTRIBUTE	N	% N	MEAN	SD
Weight Training					
	Frequency	62	83	2.9	1.6
	Intensity	53	71	6.8	2.1
	Duration	63	84	5.9	1.5
Bicycling					
	Frequency	46	61	2.5	1.7
	Intensity	37	49	5.0	2.2
	Duration	42	56	4.9	2.0
Walking					
	Frequency	17	23	3.8	2.7
	Intensity	14	19	3.2	1.9
	Duration	16	21	3.8	2.3
Rowing					
	Frequency	16	21	1.8	1.6
	Intensity	12	16	4.7	1.6
	Duration	15	20	4.5	2.1
Aerobics Class					
	Frequency	8	11	2.8	2.0
	Intensity	7	9	6.1	2.2
	Duration	8	11	4.6	1.9

Scales Key

- Frequency: 0-(never); 1-(> 0 & $\leq 1x/wk$); 2-($2x/wk$); 3-($3x/wk$); 4-($4x/wk$); 5-($5x/wk$); 6-($6x/wk$); 7-($\geq 7x/wk$)
- Intensity: 1-very easy; 2-easy; 3-; 4-moderately difficult; 5-; 6-difficult; 7-; 8-intense; 9-; 10-very intense
- Duration (minutes): 0-(N/A); 1-(< 11); 2-(11-20); 3-(21-30); 4-(31-40); 5-(41-50); 6-(51-60); 7-((61-119); 8-(120-180); 9-(> 180)

Table 8. Summary of the characteristics of skilled/sport activities of East Coast SEALs ordered by frequency of participation.

ACTIVITY	ATTRIBUTE	N	% N	MEAN	SD
Volleyball					
	Frequency	31	41	1.4	1.2
	Intensity	23	31	4.4	2.5
	Duration	31	41	6.0	1.9
Racquet Sport/Handball					
	Frequency	23	31	1.5	1.5
	Intensity	16	21	4.6	2.5
	Duration	23	31	5.5	1.6
Baseball/Softball					
	Frequency	22	29	1.8	1.6
	Intensity	19	25	3.7	2.1
	Duration	20	27	6.1	1.8
Football					
	Frequency	19	25	1.4	1.4
	Intensity	16	21	4.2	2.3
	Duration	18	24	6.2	1.6
Martial Arts					
	Frequency	15	20	2.8	1.8
	Intensity	11	15	5.4	2.7
	Duration	15	20	5.4	1.9

Scales Key

- Frequency: 0-(never); 1-(> 0 & $\leq 1x/wk$); 2-($2x/wk$); 3-($3x/wk$); 4-($4x/wk$); 5-($5x/wk$); 6-($6x/wk$); 7-($\geq 7x/wk$)
- Intensity: 1-very easy; 2-easy; 3-; 4-moderately difficult; 5-; 6-difficult; 7-; 8-intense; 9-; 10-very intense
- Duration (minutes): 0-(N/A); 1-(< 11); 2-(11-20); 3-(21-30); 4-(31-40); 5-(41-50); 6-(51-60); 7-((61-119); 8-(120-180); 9-(> 180)

Table 8. Summary of the characteristics of skilled/sport activities of East Coast SEALs ordered by frequency of participation (continued).

ACTIVITY	ATTRIBUTE	N	% N	MEAN	SD
Boxing/Wrestling					
	Frequency	12	16	1.8	1.8
	Intensity	0	0	---	---
	Duration	8	11	4.8	1.8
Other Skilled Activity					
	Frequency	6	8	2.8	2.1
	Intensity	5	7	7.4	0.9
	Duration	7	9	5.6	2.0

Scales Key

- Frequency: 0-(never); 1-(> 0 & $\leq 1x/wk$); 2-($2x/wk$); 3-($3x/wk$); 4-($4x/wk$); 5-($5x/wk$); 6-($6x/wk$); 7-($\geq 7x/wk$)
- Intensity: 1-very easy; 2-easy; 3-; 4-moderately difficult;5-; 6-difficult; 7-; 8-intense; 9-; 10-very intense
- Duration (minutes): 0-(N/A); 1-(< 11); 2-(11-20); 3-(21-30); 4-(31-40); 5-(41-50); 6-(51-60); 7-((61-119); 8-(120-180); 9-(> 180)

DISCUSSION

This report focused on physical training programs of East Coast SEALs. The principal aerobic and strength conditioning practices were documented by a questionnaire completed by SEALs. These data supplement information collected on physical profiles of BUD/S students and platoon SEALs (Beckett, et al., 1989), and on physical training activities of West Coast SEALs (Prusaczyk, et al., 1990). Additionally, a report by Stuster, et al. (1994) provides valuable information on the physically demanding tasks and missions SEALs may be required to perform.

The American College of Sports Medicine (ACSM) has published guidelines for the development and maintenance of cardiorespiratory (aerobic) and muscular (strength) fitness in healthy adults (American College of Sports Medicine, 1990). Unfortunately, these guidelines are based on average populations of Americans and may not be entirely applicable to very fit or elite

military populations, like SEALs. Both the high $\dot{V}O_{2peak}$ reported for platoon SEALs (Beckett, et al., 1989) and the results of this survey suggest that SEALs are able to maintain good cardiorespiratory fitness, despite the 8% average lower $\dot{V}O_{2peak}$ compared to BUD/S students. The ACSM guidelines suggest that to maintain aerobic fitness, exercise that involves repetitive contraction of large muscle masses (i.e., legs, arms, or both) should be performed at least three times per week, for twenty to thirty minutes per session, and at an intensity of at least 60% of $\dot{V}O_{2peak}$. On average, the SEALs in this study reported engaging in physical training activities that exceeded the levels required for maintenance of aerobic fitness. The mean values of frequency and duration reported in this survey were 4.1 times per week and 46 ± 13 minutes per session. Based on the mean minute-per-mile pace reported, mean $\dot{V}O_2$ during running (calculated for the average SEAL body weight of 175 lbs) would be 80% of the $\dot{V}O_{2peak}$ previously reported for platoon SEALs (Beckett et al., 1989). While this is slightly lower than the 85% $\dot{V}O_{2peak}$ reported for West Coast SEALs (Prusaczyk, et al., 1990), both intensities are well above the ACSM guidelines for maintenance of cardiorespiratory fitness.

Recent work by Jacobs, et al. (1994) demonstrated that SEALs can increase indicators of aerobic fitness and anaerobic capacity in as little as three weeks, training 30 minutes per day, three times per week. These data suggest that although SEALs report performing regular aerobic exercise surpassing ACSM guidelines, they could, with an effective training program, increase aerobic fitness. It has been reported that the quantity of aerobic activity is often perceived to be higher than it actually is, especially for very active individuals (Klesges, Eck, Mellon, Fulliton, Somes, & Hanson 1990). In this regard, it is possible that the exercise reported here may be somewhat higher than the actual exercise in which they regularly engage. However, based on the previous reports of SEALs' $\dot{V}O_{2peak}$ (Beckett, et al., 1989), it appears that SEALs maintain relatively high levels of aerobic fitness.

Limited scientific data are available on conditioning activities required to maintain muscular strength in fit individuals. However, it appears that even when training is discontinued or dramatically reduced, strength declines at a much slower rate than the rate at which it was gained (Fleck & Kramer, 1987). Further research is required to determine the exact loading, frequency, and type of program (e.g., sets and repetitions per set) needed to maintain individual-specific training gains in muscular strength. ACSM guidelines propose training at least two days

per week with 8 to 12 repetitions of each exercise per session to maintain muscular strength. The East Coast SEALs in this study performed weight training exercises in quantities sufficient to meet these guidelines. Weight training was performed with a mean frequency of 2.9 times per week with approximately 10 repetitions per set over an average of 4 sets per session.

Many SEAL tasks require not only muscular strength and endurance but also muscular power (Stuster, et al., 1994). It appears that muscular strength is maintained for at least four weeks when training frequency is reduced from six to one time per week; however, significant reductions (13.6%) in muscular power occurred when the frequency was reduced to three times per week (Neufer, Costill, Fielding, Flynne, & Kirwin, 1987). As with aerobic training, to maintain muscular strength, the most important characteristic of exercise is intensity (Fleck & Kramer, 1987). SEALs in this survey reported that on average the intensity of effort during weight training was between "difficult" and "intense." These reports would suggest that, in combination with the frequencies and durations reported, these SEALs will maintain levels of muscular strength. Thus, to meet the complex and diverse mission demands, it is important that the intensity of strength training be maintained to avoid loss of muscular power, especially during time of intense operational training or while deployed aboard submarines.

Natural endowment (genetic factors) plays a major role in an individual's performance capacity (Åstrand & Rodahl, 1977). However, given the right endowment, there is little doubt that proper training can further enhance physical performance and physical capacity. The principal challenge for future research is to develop training programs that most effectively use the limited time and equipment available to SEALs for developing and maintaining mission-related fitness.

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APPENDIX A
PHYSICAL ACTIVITY QUESTIONNAIRE

PHYSICAL ACTIVITY QUESTIONNAIRE

Name _____ Date _____

Height _____ Weight _____ Age _____ Organization _____

Years of experience in a SEAL Team _____ Social Security Number _____

CURRENT PHYSICAL ACTIVITY

The following questions are designed to provide information about exercise habits. Please read the instructions carefully and complete this questionnaire to the best of your ability.

Circle the number that most closely represents your present status:

- | | |
|-------------------------|-------------------------------|
| Combat Swimmer - 1 | Land Warfare - 2 |
| Maritime Operations - 3 | Exercises - 4 |
| Field Activities - 5 | Cold Weather Training - 6 |
| Classroom - 7 | Stand Down or Preparation - 8 |
| Other - 9 | |

For SDV Team only:

- | | |
|--------------------|----------|
| Core Training - 10 | AOT - 11 |
|--------------------|----------|

A. Frequency of Exercise (How many times per week or month do you exercise?)

Intensity - In the blank space next to selected frequency, place the number that best describes the intensity of each particular exercise:

1-very easy; 2-easy; 3-; 4-moderately difficult; 5-; 6-difficult; 7-; 8-intense; 9-; 10-very intense

	Never	1-4X	2X	3X	4X	5X	6X	7X
		Per Month	Per Week	Per Week	Per Week	Per Week	Per Week	Per Week or More
1. Running	0	1__	2__	3__	4__	5__	6__	7__
2. Scuba/snorkeling	0	1__	2__	3__	4__	5__	6__	7__
3. Swimming	0	1__	2__	3__	4__	5__	6__	7__
4. Bicycling	0	1__	2__	3__	4__	5__	6__	7__
5. Rowing	0	1__	2__	3__	4__	5__	6__	7__
6. Continuous walking	0	1__	2__	3__	4__	5__	6__	7__
7. Aerobic exercise class	0	1__	2__	3__	4__	5__	6__	7__
8. Weightlifting	0	1__	2__	3__	4__	5__	6__	7__
9. Calisthenics	0	1__	2__	3__	4__	5__	6__	7__
10. Racket sports/handball	0	1__	2__	3__	4__	5__	6__	7__
11. Basketball	0	1__	2__	3__	4__	5__	6__	7__
12. Baseball/softball	0	1__	2__	3__	4__	5__	6__	7__
13. Football	0	1__	2__	3__	4__	5__	6__	7__
14. Volleyball	0	1__	2__	3__	4__	5__	6__	7__
15. Boxing/wrestling	0	1__	2__	3__	4__	5__	6__	7__
16. Martial arts	0	1__	2__	3__	4__	5__	6__	7__
17. Obstacle course	0	1__	2__	3__	4__	5__	6__	7__
18. Other (specify: _____)	0	1__	2__	3__	4__	5__	6__	7__

B. Duration of Workouts (What is the average time per session you spend exercising?)

	Not Appli- cable	Less Than 11 Minutes	11-20 Minutes	21-30 Minutes	31-40 Minutes	41-50 Minutes	51-60 Minutes	61-119 Minutes	2-3 Hours	More Than 3 Hours
1. Running	0	1	2	3	4	5	6	7	8	9
2. Scuba/snorkeling	0	1	2	3	4	5	6	7	8	9
3. Swimming	0	1	2	3	4	5	6	7	8	9
4. Bicycling	0	1	2	3	4	5	6	7	8	9
5. Rowing	0	1	2	3	4	5	6	7	8	9
6. Continuous walking	0	1	2	3	4	5	6	7	8	9
7. Aerobic exercise class	0	1	2	3	4	5	6	7	8	9
8. Weightlifting	0	1	2	3	4	5	6	7	8	9
9. Calisthenics	0	1	2	3	4	5	6	7	8	9
10. Racket sports/handball	0	1	2	3	4	5	6	7	8	9
11. Basketball	0	1	2	3	4	5	6	7	8	9
12. Baseball/softball	0	1	2	3	4	5	6	7	8	9
13. Football	0	1	2	3	4	5	6	7	8	9
14. Volleyball	0	1	2	3	4	5	6	7	8	9
15. Boxing/wrestling	0	1	2	3	4	5	6	7	8	9
16. Martial arts	0	1	2	3	4	5	6	7	8	9
17. Other (specify: _____)	0	1	2	3	4	5	6	7	8	9

C. Exercise History (How long have you been on this or a similar schedule?)

	Not Appli- cable	Less Than 1 Month	1-3 Months	4-11 Months	1-2 Years	3-4 Years	5 Years or More
1. Running	0	1	2	3	4	5	6
2. Scuba/snorkeling	0	1	2	3	4	5	6
3. Swimming	0	1	2	3	4	5	6
4. Bicycling	0	1	2	3	4	5	6
5. Rowing	0	1	2	3	4	5	6
6. Continuous walking	0	1	2	3	4	5	6
7. Aerobic exercise class	0	1	2	3	4	5	6
8. Weightlifting	0	1	2	3	4	5	6
9. Calisthenics	0	1	2	3	4	5	6
10. Racket sports/handball	0	1	2	3	4	5	6
11. Basketball	0	1	2	3	4	5	6
12. Baseball/softball	0	1	2	3	4	5	6
13. Football	0	1	2	3	4	5	6
14. Volleyball	0	1	2	3	4	5	6
15. Boxing/wrestling	0	1	2	3	4	5	6
16. Martial arts	0	1	2	3	4	5	6
17. Other (specify: _____)	0	1	2	3	4	5	6

D. Exercise Surfaces/Equipment (How often do you exercise on these surfaces/use this equipment?)

	Not Appli- cable	1-4X Per Month	2X Per Week	3X Per Week	4X Per Week	5X Per Week	6X Per Week	7X Per Week or More
1. Run on soft sand	0	1	2	3	4	5	6	7
2. Run on hard sand or packed dirt	0	1	2	3	4	5	6	7
3. Run on grass	0	1	2	3	4	5	6	7
4. Run on asphalt	0	1	2	3	4	5	6	7
5. Run on concrete	0	1	2	3	4	5	6	7
6. Run on artificial track surface	0	1	2	3	4	5	6	7
7. Scuba/snorkel in pool	0	1	2	3	4	5	6	7
8. Scuba/snorkel in ocean	0	1	2	3	4	5	6	7
9. Scuba/snorkel with fins	0	1	2	3	4	5	6	7
10. Scuba/snorkel without fins	0	1	2	3	4	5	6	7
11. Swim in pool	0	1	2	3	4	5	6	7
12. Swim in ocean	0	1	2	3	4	5	6	7
13. Swim with fins	0	1	2	3	4	5	6	7
14. Swim without fins	0	1	2	3	4	5	6	7
15. Bicycle on the road	0	1	2	3	4	5	6	7
16. Bicycle on a stationary cycle	0	1	2	3	4	5	6	7
17. Row a boat or shell	0	1	2	3	4	5	6	7
18. Row on a machine	0	1	2	3	4	5	6	7
19. Play racket sports/handball on wood	0	1	2	3	4	5	6	7
20. Play racket sports/handball on asphalt	0	1	2	3	4	5	6	7
21. Play racket sports/handball on concrete	0	1	2	3	4	5	6	7
22. Play basketball on wood	0	1	2	3	4	5	6	7
23. Play basketball on asphalt	0	1	2	3	4	5	6	7
24. Play basketball on concrete	0	1	2	3	4	5	6	7
25. Play volleyball on sand	0	1	2	3	4	5	6	7
26. Play volleyball on grass	0	1	2	3	4	5	6	7
27. Play volleyball on wood	0	1	2	3	4	5	6	7
28. Play volleyball on asphalt	0	1	2	3	4	5	6	7
29. Play volleyball on concrete	0	1	2	3	4	5	6	7

H. Weightlifting (If you do not lift weights, skip this section)

Repetition = one complete exercise movement

Set = a number of continuous repetitions

1-repetition maximum = the greatest weight that can be lifted in one repetition

Intensity (In this column, place the number that best describes the intensity of each particular exercise):

1-very easy; 2-easy; 3-; 4-moderately difficult; 5-; 6-difficult; 7-; 8-intense; 9-; 10-very intense

Modality (In this column, place the number that best describes the modality of each particular exercise):

1-free weights; 2-universal; 3-nautilus; 4-friction or hydraulic resistance; 5-other

IF YOUR SETS, REPETITIONS, OR LOADS VARY, USE THE AVERAGE FOR YOUR RESPONSE TO THESE QUESTIONS

Body Weight: _____ pounds

Exercise	1 Repetition Maximum	Sets	Repetitions	Intensity	Average Weight	Duration*	Modality
Neck	_____	_____	_____	_____	_____	_____	_____
Upright Rowing	_____	_____	_____	_____	_____	_____	_____
Bent Rowing	_____	_____	_____	_____	_____	_____	_____
Bench Press	_____	_____	_____	_____	_____	_____	_____
Military Press	_____	_____	_____	_____	_____	_____	_____
Incline Press	_____	_____	_____	_____	_____	_____	_____
Biceps Curl	_____	_____	_____	_____	_____	_____	_____
Triceps Curl	_____	_____	_____	_____	_____	_____	_____
Wrist Curl	_____	_____	_____	_____	_____	_____	_____
Sit-up with weights	_____	_____	_____	_____	_____	_____	_____
Leg Press	_____	_____	_____	_____	_____	_____	_____
Squat	_____	_____	_____	_____	_____	_____	_____
Leg Curl	_____	_____	_____	_____	_____	_____	_____
Toe Raises	_____	_____	_____	_____	_____	_____	_____
Latissimus Pull	_____	_____	_____	_____	_____	_____	_____
Leg Extension	_____	_____	_____	_____	_____	_____	_____
Stair Climb	_____	_____	_____	_____	_____	_____	_____
Others (specify)	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____

*Entire time spent performing this exercise, including rest between sets.

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