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Abstract

From June 13th to August 18th Shannon Point Marine Center of Western Washington University hosted the 2011 American Academy of Underwater Sciences/Our World Underwater Scholarship Society Scientific Diving Internship in Anacortes, WA. The internship consisted of the following components: 1) general and specialized diving knowledge and skill development, 2) project specific dive training and assistance with diving research, and 3) introduction to scientific dive program management. The 2011 intern demonstrated expertise in all program areas by obtaining lead scientific diver status and additionally mastering the specialized knowledge and skill set of research tasks associated with the recovery of threatened pinto abalone Haliotis kamtschatkana. Also, by assisting the diving safety officer with dive program management, the intern was able to familiarize herself with the professional responsibilities of maintaining organizational membership with AAUS while balancing the needs and limitations of the institution.

Keywords: AAUS training, dive program management, H. kamtschatkana

Diving Knowledge

The AAUS scientific diving program has had a longstanding tradition of diver safety by way of rigorous education and training standards. In accordance with these standards the intern completed twelve training modules of the AAUS Scientific Diver Course through SPMC's scientific diving program. First aid requirements were met by obtaining certification through alternate training programs, specifically with Divers Alert Network (DAN) Diving First Aid for Professional Divers and On-Site Neurological Assessment courses encompassing basic first aid, CPR, AED procedures, hazardous marine life injuries, neurological exam techniques and emergency oxygen administration (Lang et al., 2007). Nitrox, Drysuit, Advanced Open Water, and Rescue Diver certifications were also completed by the intern, exceeding the minimum safety requirements of AAUS divers (PADI, 2010).

Lead Diver Status and Local Environment Dive Planning

While diving first aid and theory were emphasized during initial training, a wide range of applied diving skills were developed throughout the summer. A total of 51 dives were completed during the internship and lead diver responsibilities were assumed during 18 of the dives (Table 1). This included organizing dives, checking qualifications of individual divers, briefing all dive teams on dive plans and profiles, conducting safety checks, and forming dive specific emergency action plans (AAUS, 2009). Additionally, the intern learned specific diving limitations of the Pacific Northwest including seasonal minimum temperatures of 8°C and average visibility of 3–4 m. The primary
safety concerns in local waters were strong currents and short average slack tide windows of 20–30 minutes between 0.5 knot ebb and 0.5 knot flood exchanges. The intern terminated two dives while acting as lead diver due to dangerous current conditions adhering to Section 2.30 of the AAUS Standards (AAUS, 2009).

Table 1. Summary of Internship Dives

<table>
<thead>
<tr>
<th>Dive Category</th>
<th># Dives</th>
<th>As Lead Diver</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training Dives</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>Abalone Surveys</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td>Brood Stock Collections</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Water Quality Analysis</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CTD Retrieval/Deployment</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Intake Surveys</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Organism Collection</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>51</strong></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>

**Practical Diving Skill Development**

Practical diving skills were continually improved during the internship through close mentoring scenarios. The SPMC DSO participated in all swimming examinations and presented a discussion on the health and safety benefits of maintaining diver fitness (Ma and Pollock, 2007). Advanced Open Water certification was obtained through search and recovery, night, drift, deep, and navigation specialty dives with the DSO (PADI, 2010). The safety officer also conducted several in-water training sessions incorporating check-out skills, rescue scenarios, and the divemaster level full equipment exchange while buddy breathing exercise. These individual training opportunities provided the intern with the ability to learn from their mistakes and develop effective problem solving skills, emphasizing the importance of mentoring in scientific diving (Pollock, 2007).

**Underwater Research: Native Pinto Abalone, Haliotis kamtschatkana**

A significant portion of the internship included working on native pinto abalone restoration efforts with the Puget Sound Restoration Fund and the Washington Department of Fish and Wildlife. One day was spent learning about current restoration projects and touring a NOAA hatchery facility designed for the threatened pinto abalone, *H. kamtschatkana*. This species reproduces by way of broadcast spawning and must live within close proximity of one another for successful egg fertilization (Rothaus et al., 2008). As such, the WDFW permits the PSRF to collect solitary adult abalone in order to assist with their hatchery efforts. The intern participated in five dives supporting these brood stock collections of reproductively isolated individuals within the San Juan Archipelago (Table 1).

An alternative aspect of *H. kamtschatkana* recovery efforts involved assisting a National Science Foundation funded Research Experience for Undergraduates (REU) student with their research on pinto abalone. The intern conducted 26 research dives laying transects, surveying, and recovering gear related to pinto abalone monitoring projects (Table 1). In areas where hatchery raised *H. kamtschatkana* had been previously outplanted, the intern and REU student set up six 10 m x 10 m transects. The plots were divided into five 2.0 m lanes running north to south and each lane was surveyed for approximately 20 minutes at a rate of 1.0 m²·min⁻¹. All sites were surveyed according to
WDFW standards in order to obtain pinto abalone population estimates, growth rates, and survival rates (Bouma, 2007). One of the sites was surveyed four times to investigate method accuracy and perimeter surveys were conducted to assess the resettlement and emigration of the outplanted juveniles (Hester et al., 2011).

Scientific Diving Techniques

A variety of scientific diving techniques were learned throughout the summer in addition to setting up transects, brood stock collections, and abundance surveys. The intern assisted other REU students at SPMC by collecting marine organisms that were required for their experiments, most notably *Armina californica*, *Diaulula sandiegensis* and *Ptilosarcus gurneyi*. Collections were also conducted for resident scientists at SPMC and display tanks at community outreach events. Surface and benthic water samples were collected from the Salish Sea for water quality analysis by SPMC. A Sea Bird Electronics (SBE) CTD was retrieved and re-deployed monthly for local water profile analysis by the Washington State Department of Ecology. SPMC’s sea water intake system was transected, photographed, and surveyed by the intern in order for the Washington Department of Natural Resources to assess the local impacts of building the system. Finally, scientific diving techniques not utilized by SPMC were discussed in detail in order to familiarize the intern with a variety of common diving field procedures (Heine, 1999).

Scientific Diving Program Management

The intern explored diving program management by obtaining an overview of the administrative responsibilities of a DSO. This included learning about the organization and planning of field operations as well as what goes into approving a new diving project. The amount of work put into teaching the Scientific Diver course was discussed along with the liability and personal responsibility that comes with being an instructor (Lang et al., 2007). A potential career path was investigated through learning the minimum qualifications of a DSO and scuba instructor. As a final insight into the responsibilities of a DSO the intern participated in an SPMC Diving Control Board meeting, presenting a summary of their involvement in scientific diving projects.

Conclusions

At the completion of the internship, lead diver status and a Verification of Training Letter were acquired from SPMC’s scientific diving program. Extensive in-water training benefitted the intern with her practical diving skills and ability to cope with emergency situations. For future interns it is recommended that mentorships be established with all training professionals in order to increase the individual's problem solving abilities. These elevated training standards have led to the production of a safety conscious and qualified rescue professional diver, capable of using scientific diving as a research tool for a future career in the marine sciences.

Acknowledgments

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